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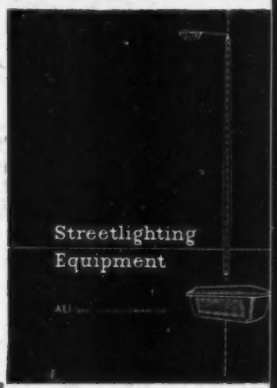

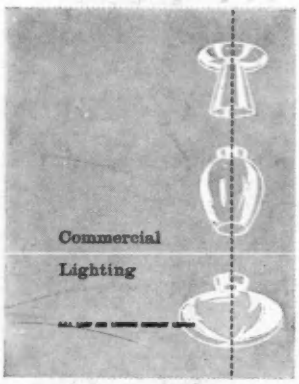

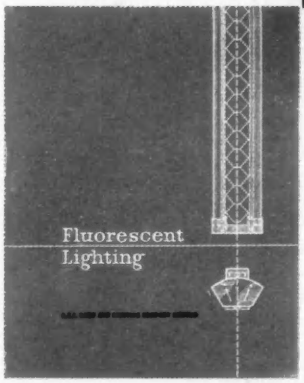

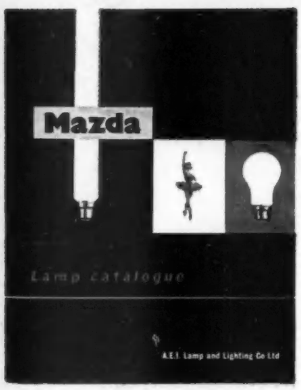

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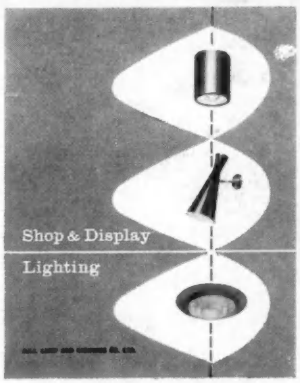

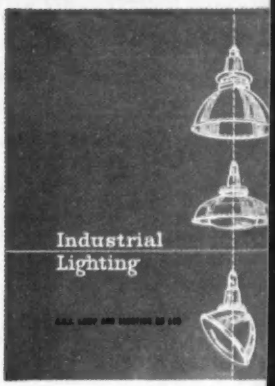

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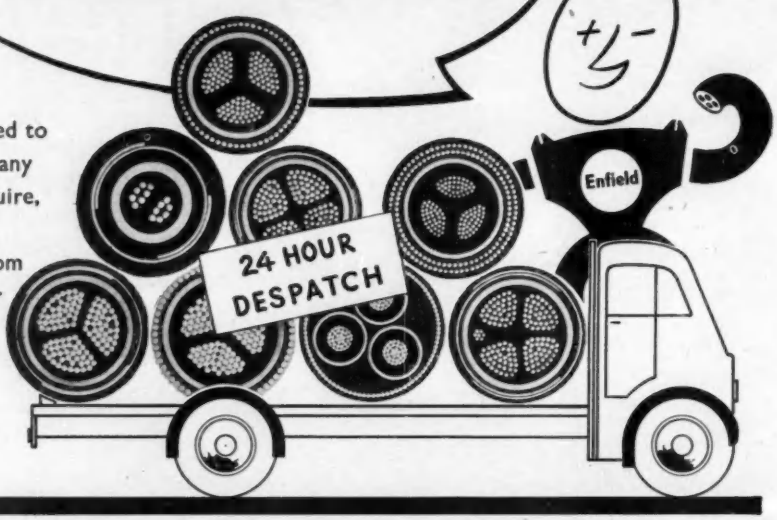

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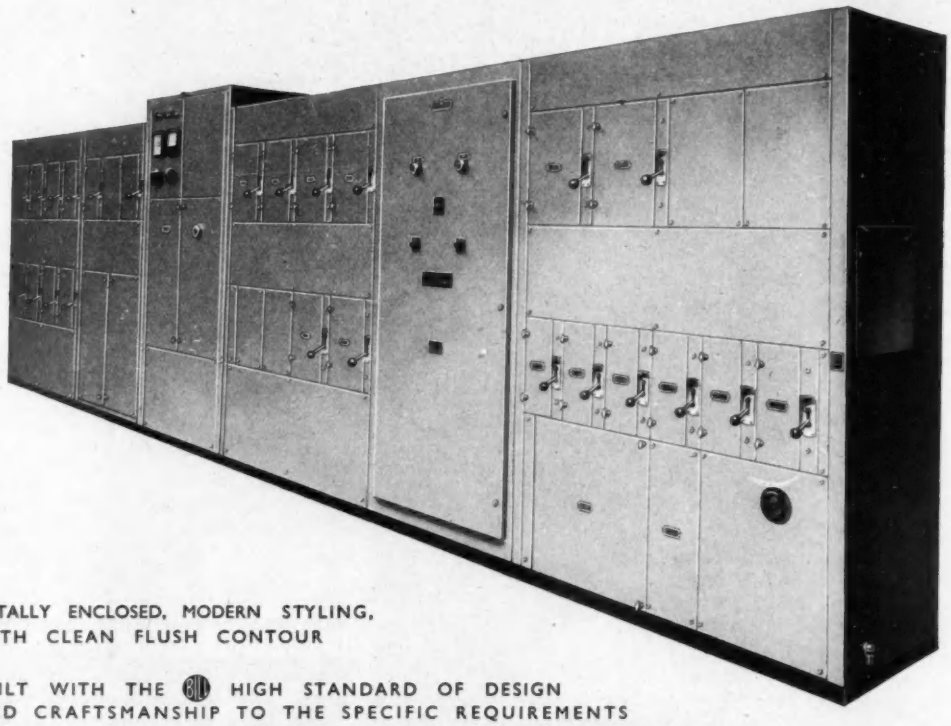

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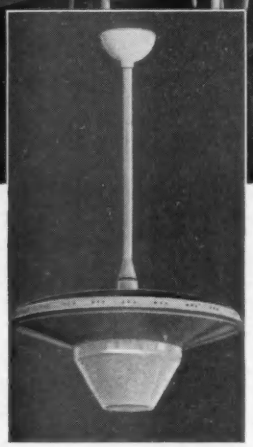

Mandarin Hat lighting fittings in Britannia House, Birmingham, made from 'Perspex' acrylic sheet by Fulford Brown Brothers (1929) Ltd.

Colourful efficient lighting fittings in 'Perspex'

A restaurant with 'Perspex' acrylic sheet lighting fittings is a gayer, brighter, lighter restaurant. This one in I.C.I.'s new Office block Britannia House, Birmingham, has exciting Mandarin Hat fittings made from opal 'Perspex' and red, yellow and green 'Perspex'. Fittings like these are designed to remain attractive for many years and they are easy to clean and maintain. 'Perspex' fittings are unaffected by atmospheric changes.

'Perspex' is a tough, light material. It is easy to shape, which allows designers scope for making attractive fittings like the Mandarin Hat.

'Perspex' is available in a wide range of transparent, translucent and opaque colours as well as in clear and opal sheet.

'PERSPEX'

'Perspex' is the registered trade mark for the acrylic sheet manufactured by I.C.I.

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"BELLING-LEE" MINIATURE *Unitors*

WITH 8 OR 12 CONTACTS

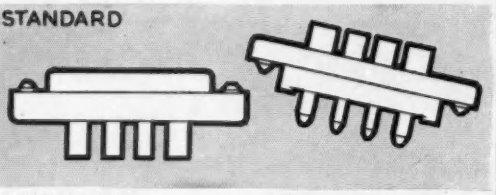
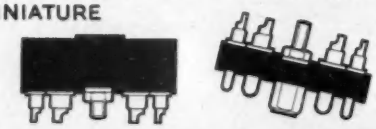
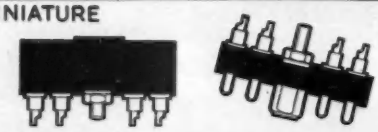
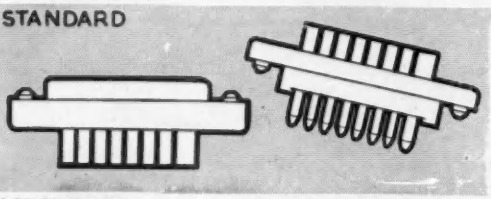
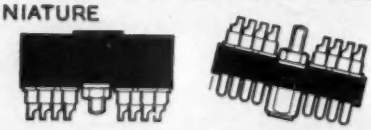
For the inter-connection of units in one assembly where space and weight considerations prevent the use of standard Unitors, we have designed and developed this new range of Miniature Unitors in the "Domino" series.

Moisture- and tracking-resistant nylon-filled phenolic material is used for body mouldings. Pins are of gold-plated* or silver-plated brass. Sockets of high grade beryllium copper, slotted to ensure good contact with pin.

** As distinct from gold flash.*

Each assembly has a shaped centre pin which polarizes the plug on engagement, and the back of this pin carries an 8BA stud for mounting the Unitor on chassis or panel.

Various pin combinations and arrangements are possible within the same chassis cut-out, to give a highly flexible method of obtaining an individual connection for each group of inter-connections.

ACTUAL SIZE	LIST No.	DIMNS. IN INS.	WEIGHT IN OZS.	No. OF PINS
STANDARD 	L./654/P	1·484 x ·578 x ·640	0·25	8 (two large)
	L./654/S	1·484 x ·578 x ·531	0·23	
MINIATURE 	L./1387/P	·990 x ·366 x ·593	0·18	8 (four large)
	L./1387/S	·990 x ·366 x ·562	0·18	
MINIATURE 	L./1388/P	·990 x ·366 x ·593	0·13	8
	L./1388/S	·990 x ·366 x ·562	0·16	
STANDARD 	L./655/P	1·500 x ·843 x ·640	0·35	12 (two large)
	L./655/S	1·500 x ·843 x ·531	0·34	
MINIATURE 	L./1389/P	·990 x ·366 x ·593	91·0	12
	L./1389/S	·990 x ·366 x ·562	0·18	

SPECIFICATION OF MINIATURE RANGE

CURRENT RATING
(SMALL PINS)
5A. each for a 20°C. rise in temperature.

BREAKDOWN VOLTAGE
(LOWEST VALUES,
With prototype shroud
Between Pins: 3kV. (Sea-level) 500V. (At 68,000 ft.)
Pins to earth: 2·5 kV. (Sea-level) 500V. (At 68,000 ft.)

INSULATION RESISTANCE
In all cases greater than 100 megohms.

CONTACT RESISTANCE
(MAXIMUM VALUES)
These tests were made on the small pins only. Initial maximum value 2·1 milliohms. Maximum value after cycling 2·8 milliohms.

WITHDRAWAL FORCE
8 oz./pin.

These components are the subject of various patents and/or patents pending.

These miniature Unitors and other new developments are fully described in the Supplement (No. P490/H) to our General Catalogue: copies are available on request.

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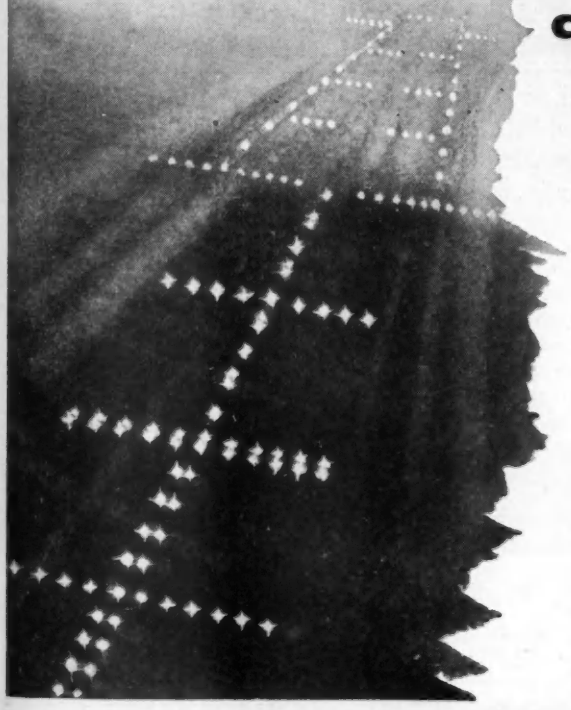
Yorkshire Switchgear brings them down*-at Gatwick



The steadily increasing importance of Gatwick Airport gives added significance to the recent installation of Yorkshire Switchgear.
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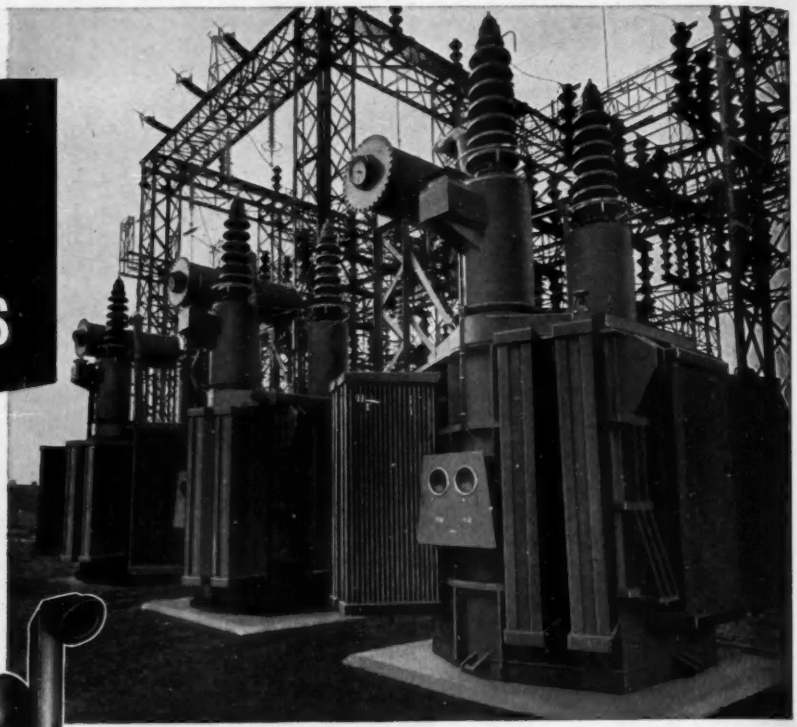

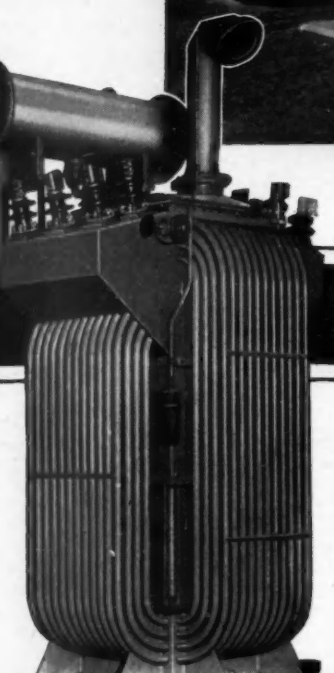

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The illustrations show typical Hackbridge magnetically shielded reactors. Above: at Coventry Generating Station for introducing 18% reactance into the 90 MVA 132 kV. system; and below, for introducing a 3.75% reactance into a 30 MVA 6.6 kV. system.

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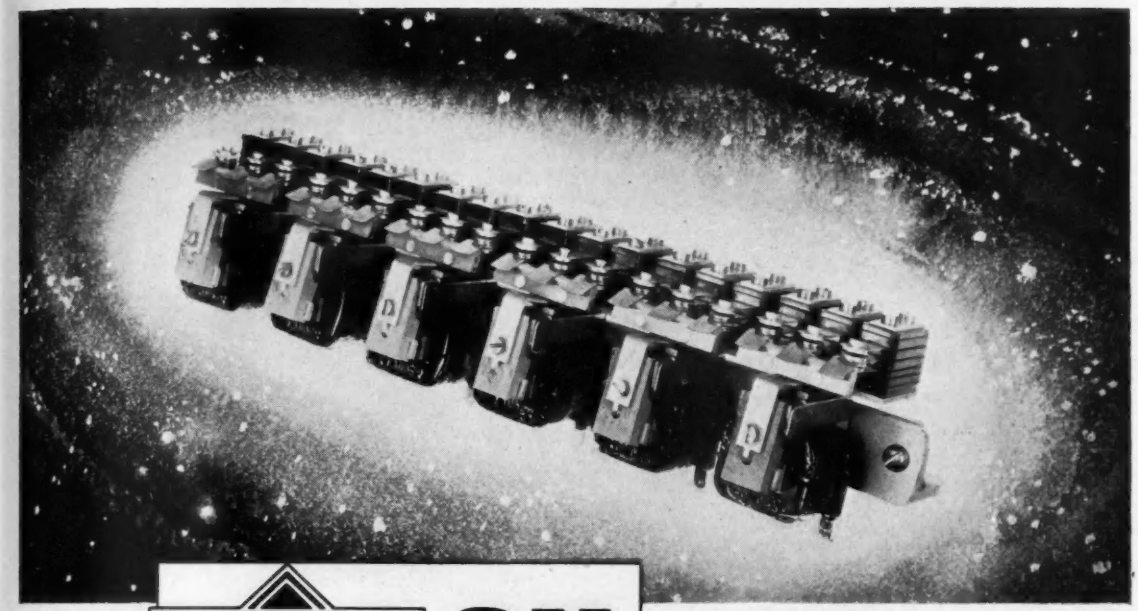

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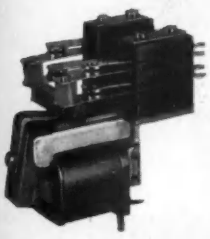
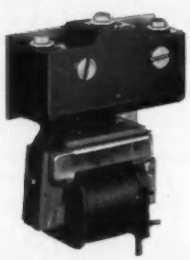


Multiple contact relay type SF. Contacts up to 3 pole DT. Rating 2A 250v AC

Mercury switch relay type SMQ. Contacts up to SPDT. Rating 10A 250v AC



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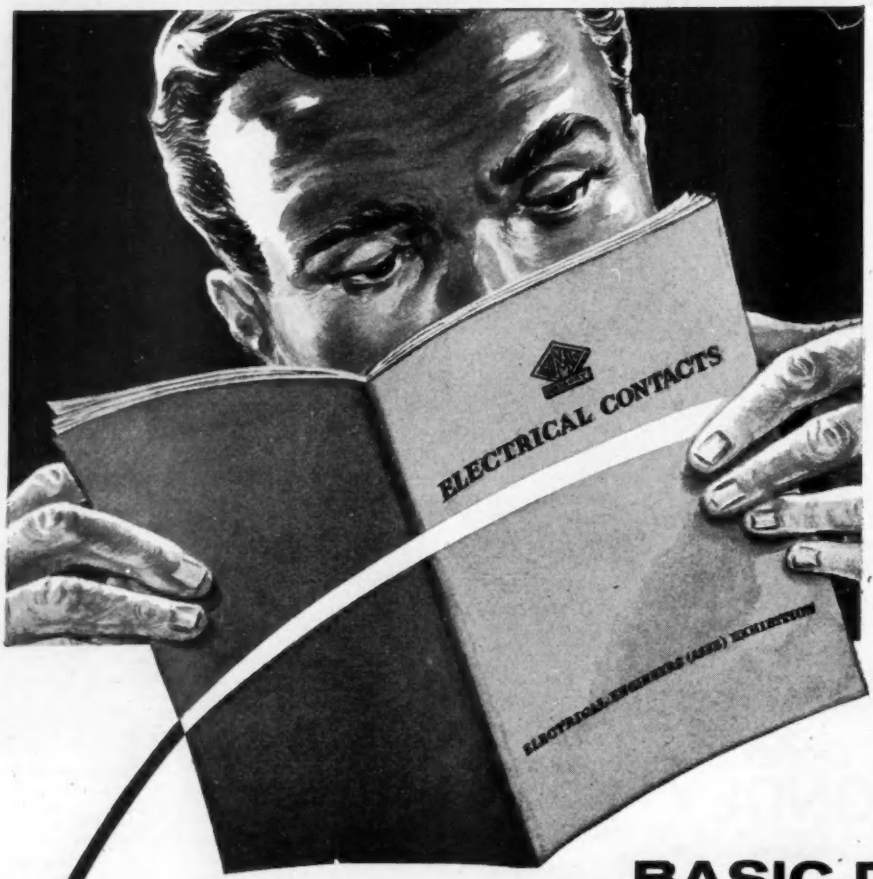

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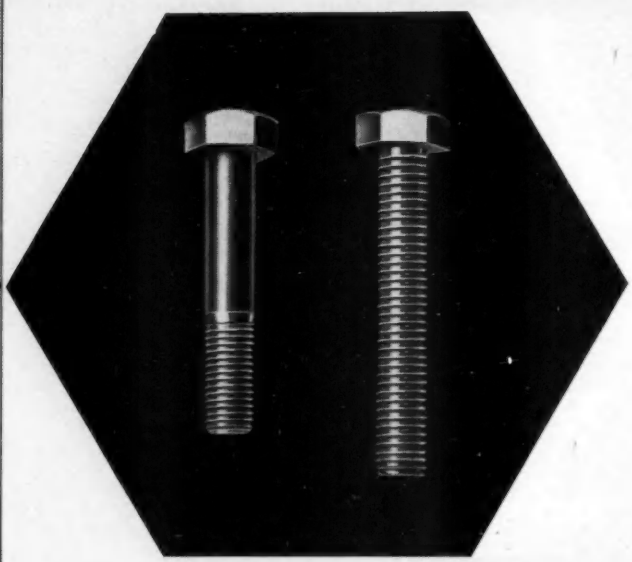

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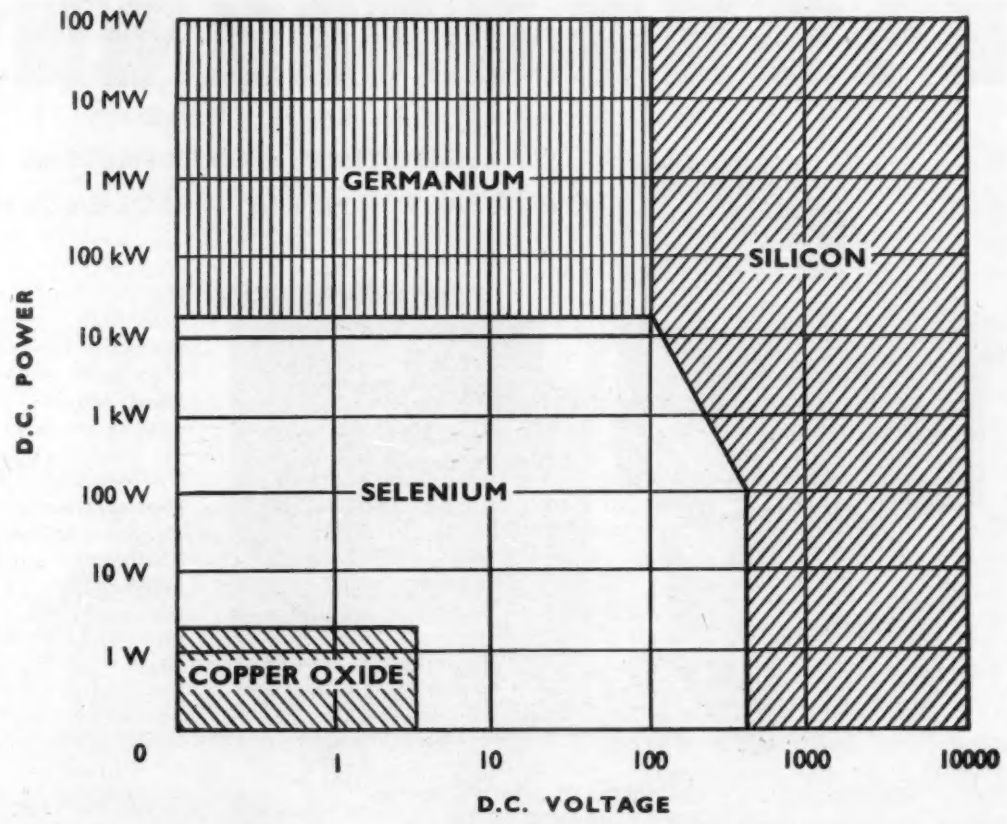

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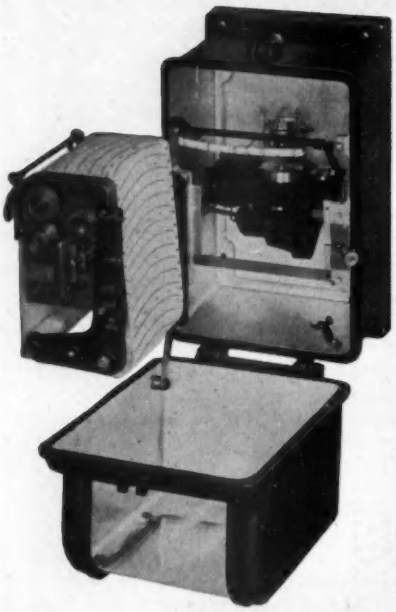

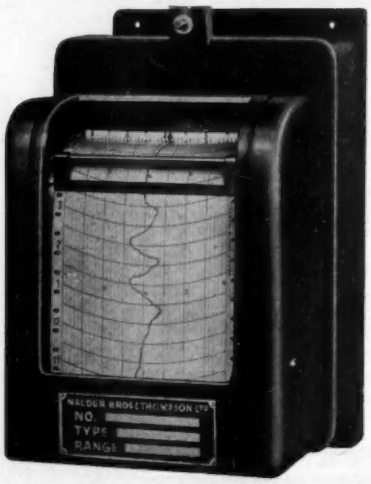

Nalders Graphic Recording Instruments illustrated at left and below, show the Standard and Duplex models, switchboard pattern. Picture on extreme left shows the simplicity of opening the instruments for recharting. A complete range of recording instruments, for both switchboard and portable patterns, is offered for all meters.

Nalders Recording Instruments are made to their usual high level of accuracy and are well within the requirements of B.S. Specification.

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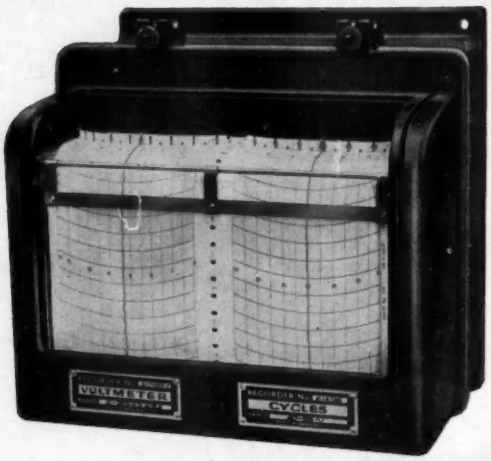

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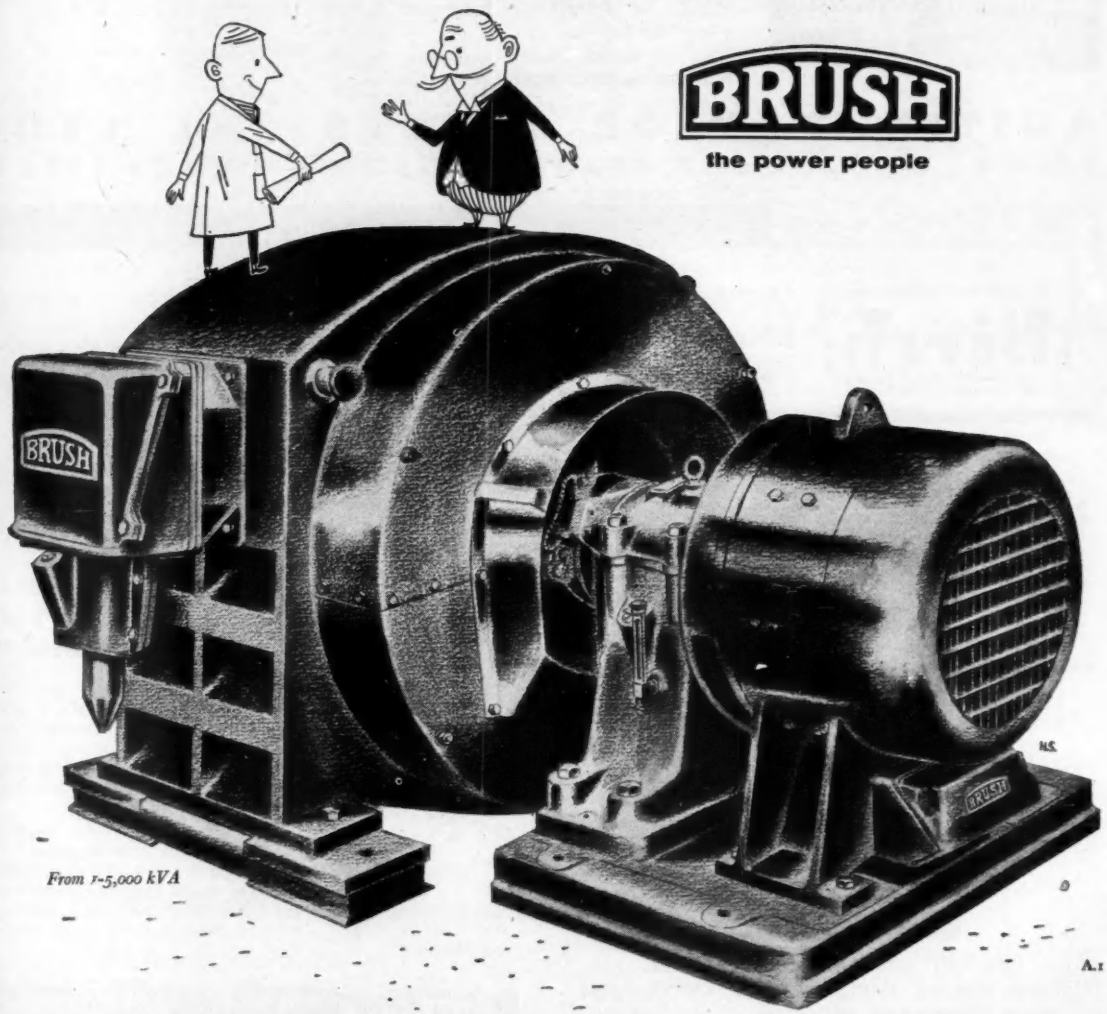
BRUSH
the power people



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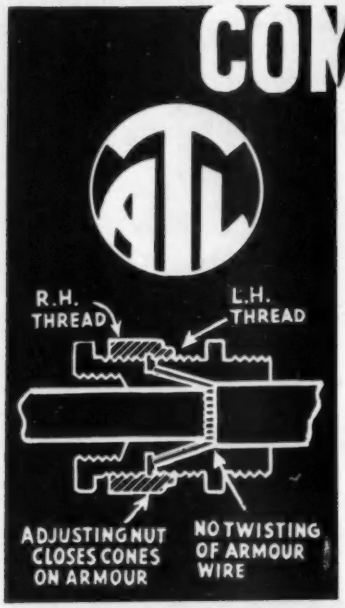

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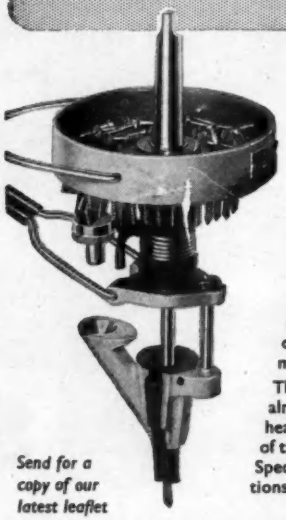

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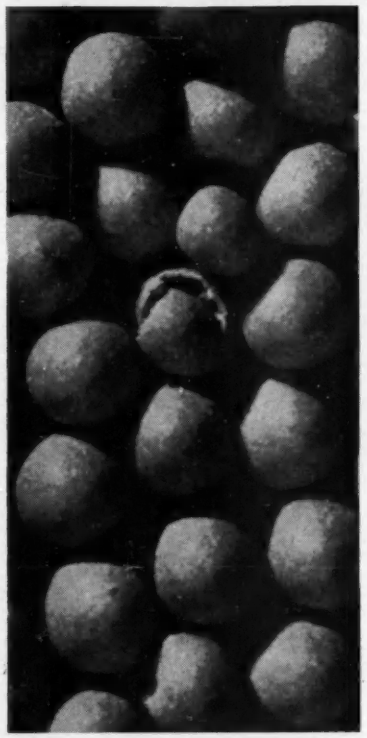

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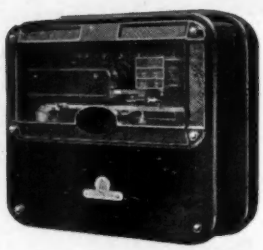

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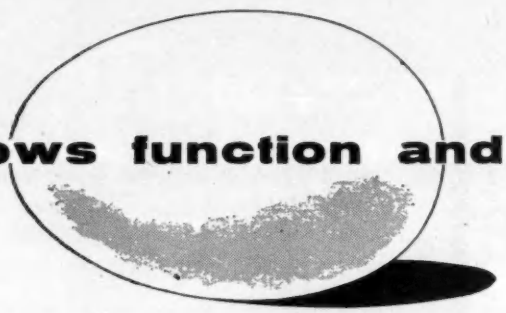

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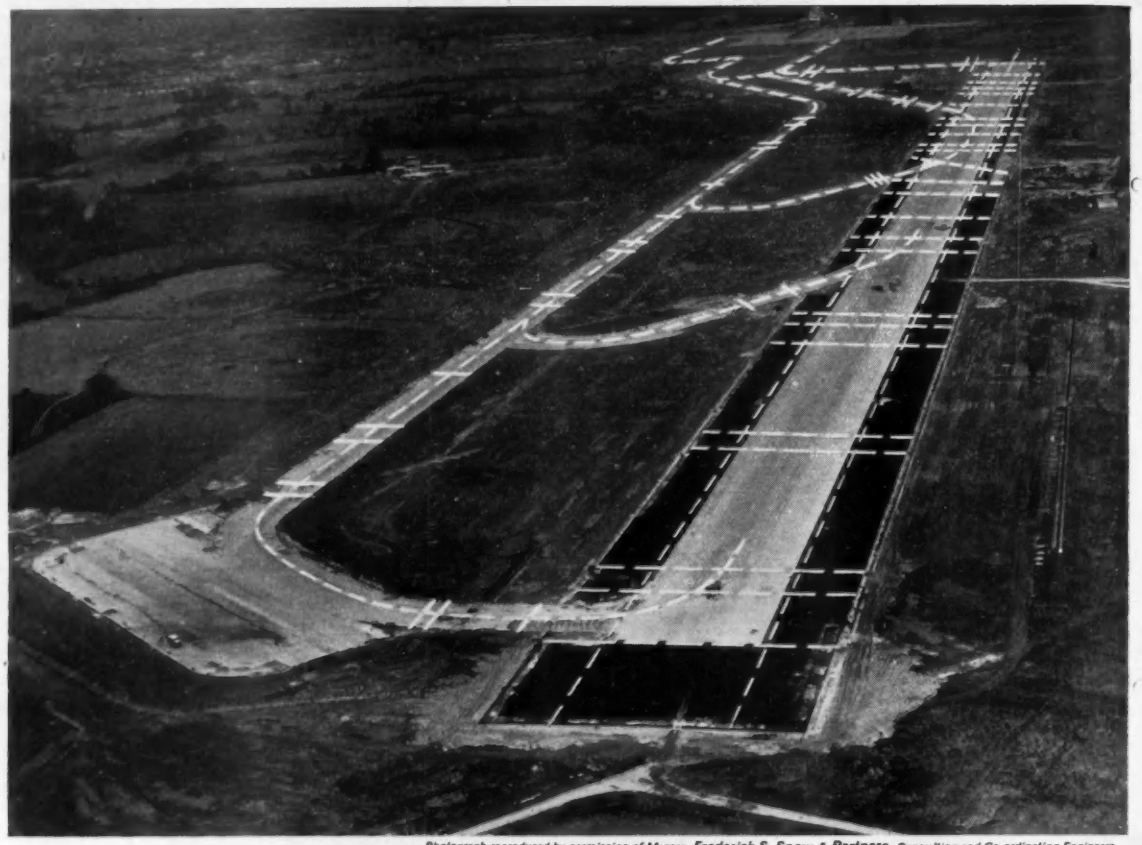

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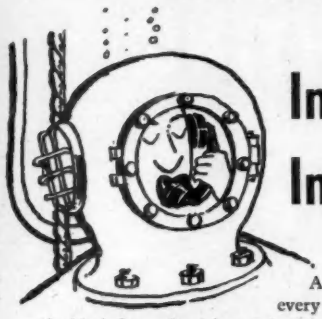

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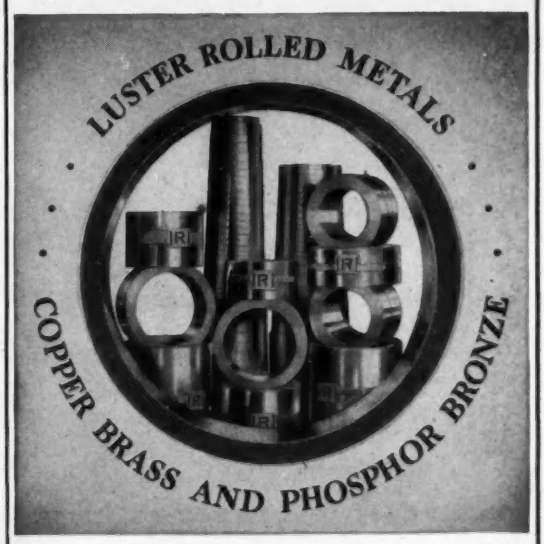

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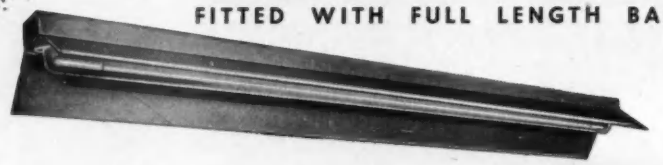

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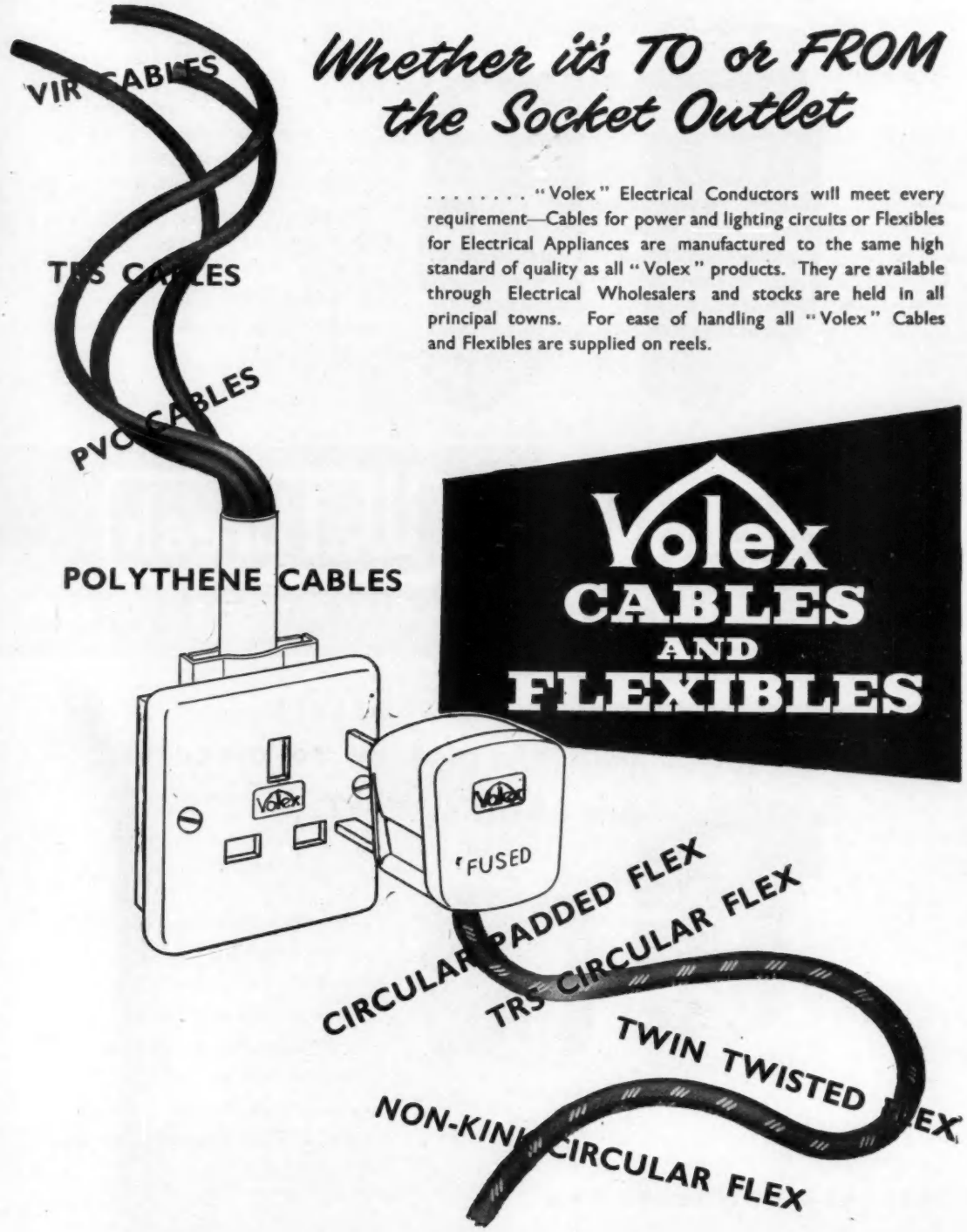

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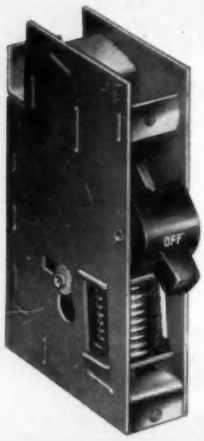

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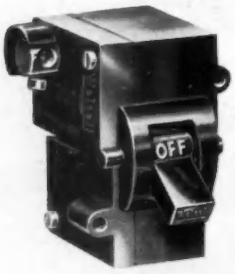

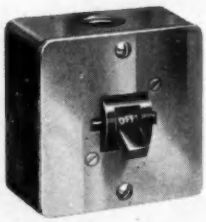

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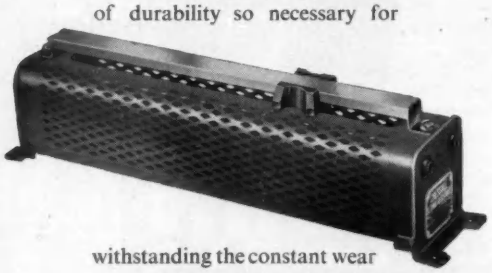

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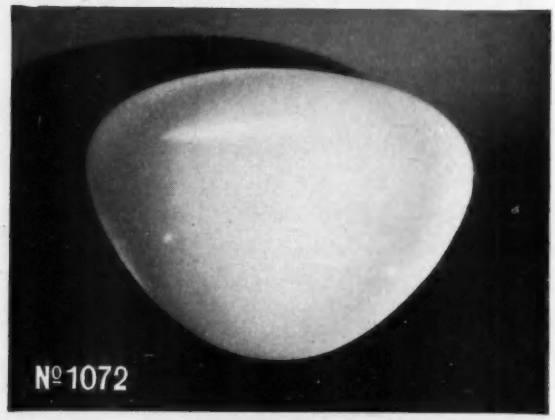

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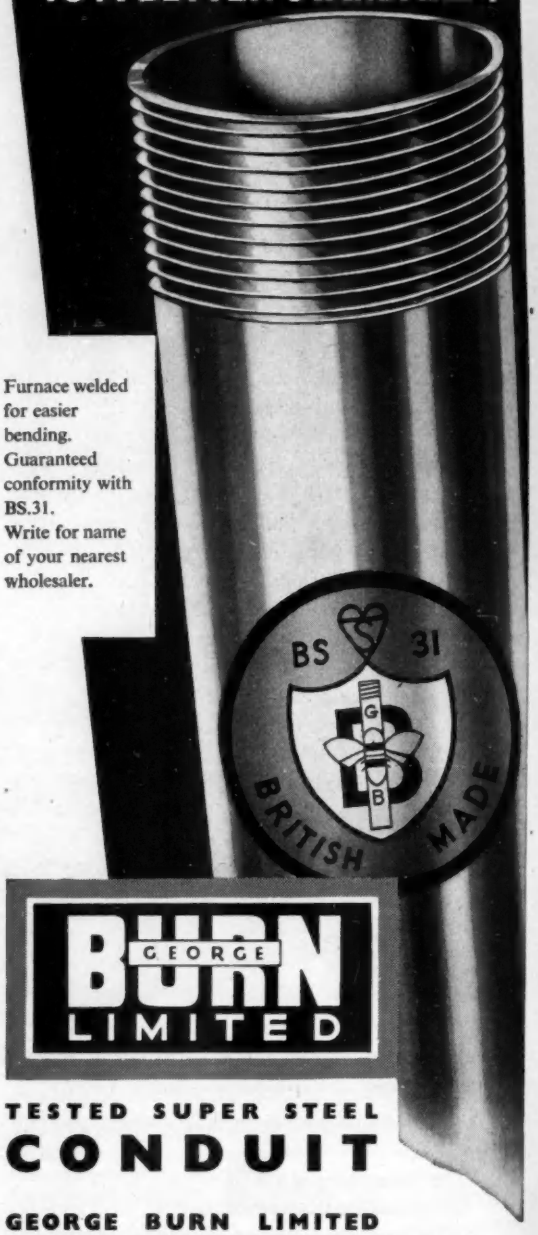

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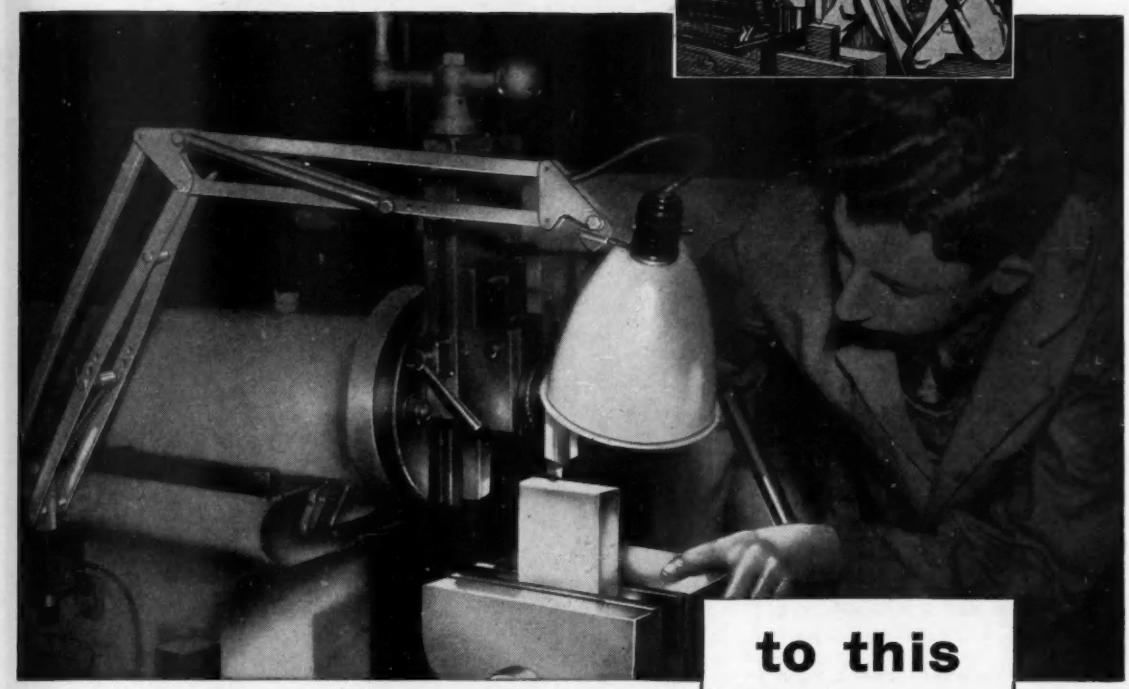

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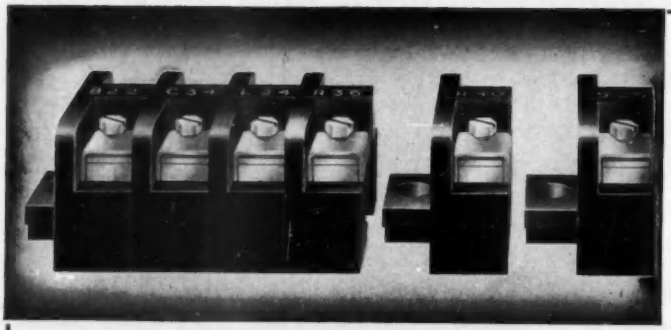

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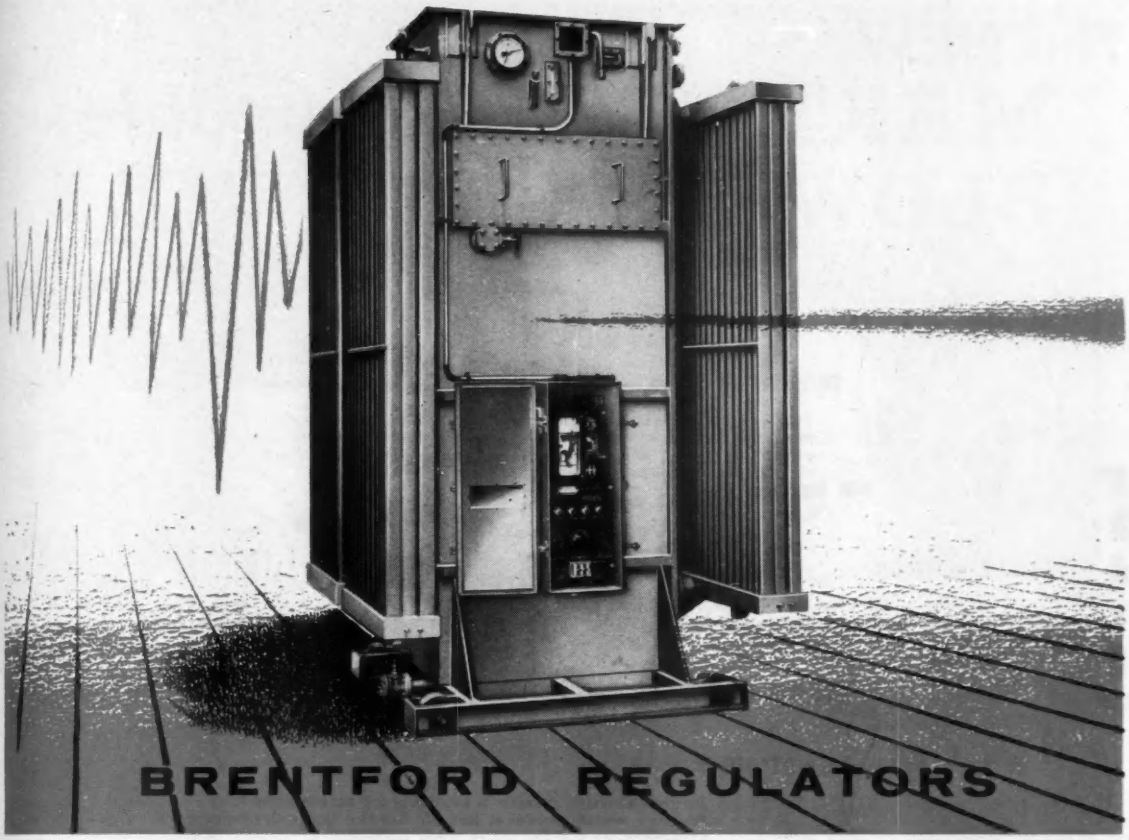

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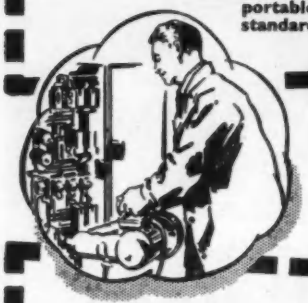
All of the five blowers are instantly converted into portable industrial suction cleaners by the use of standard attachments at little cost.



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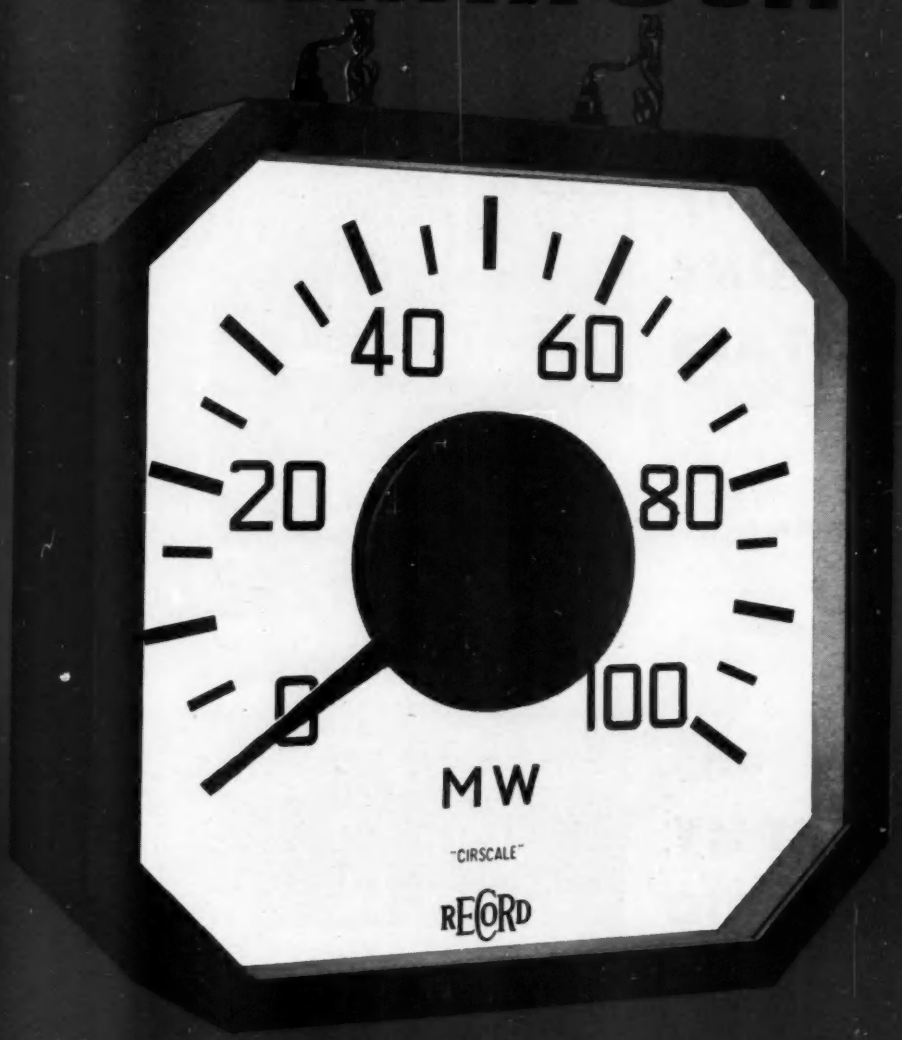

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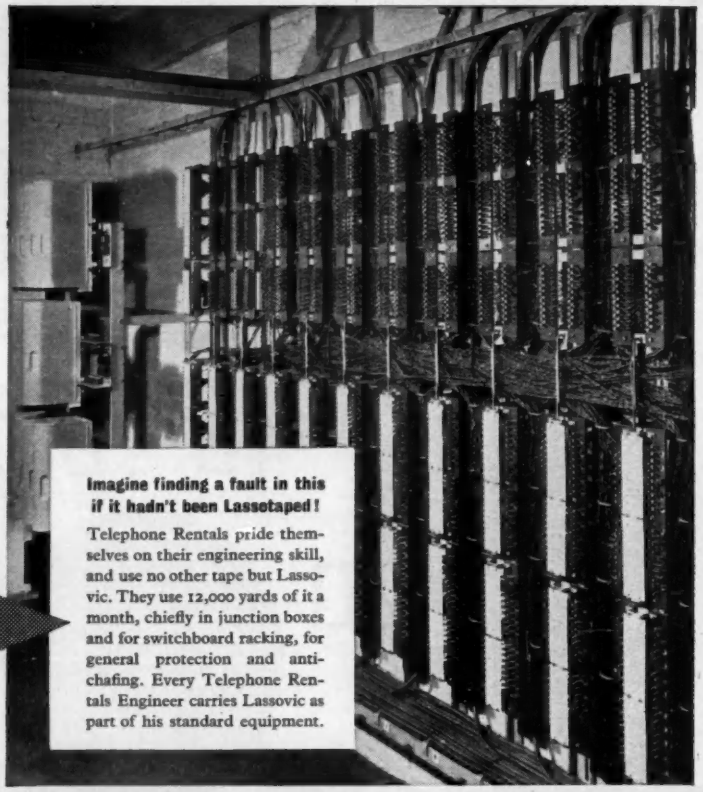

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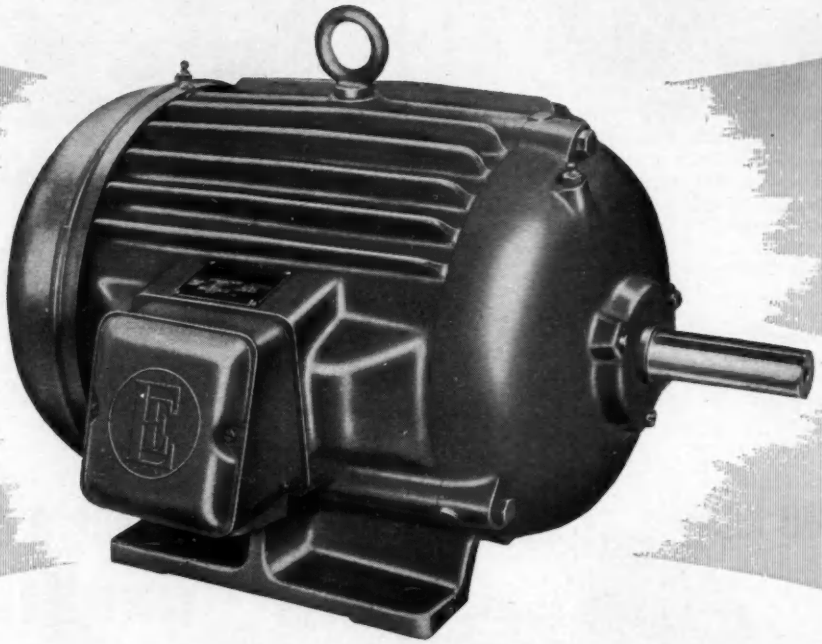

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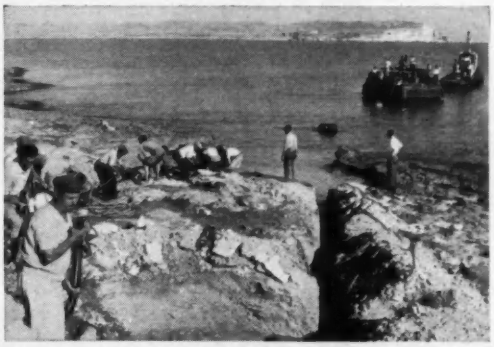

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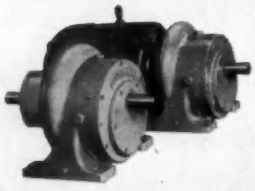

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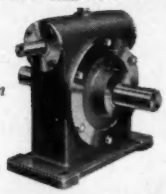

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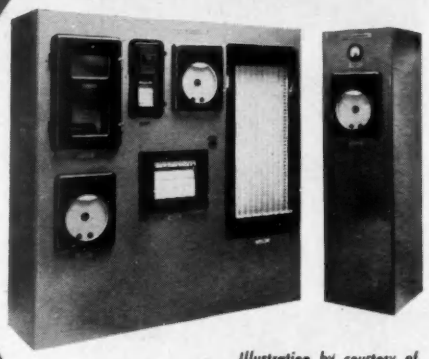

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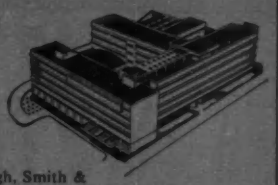

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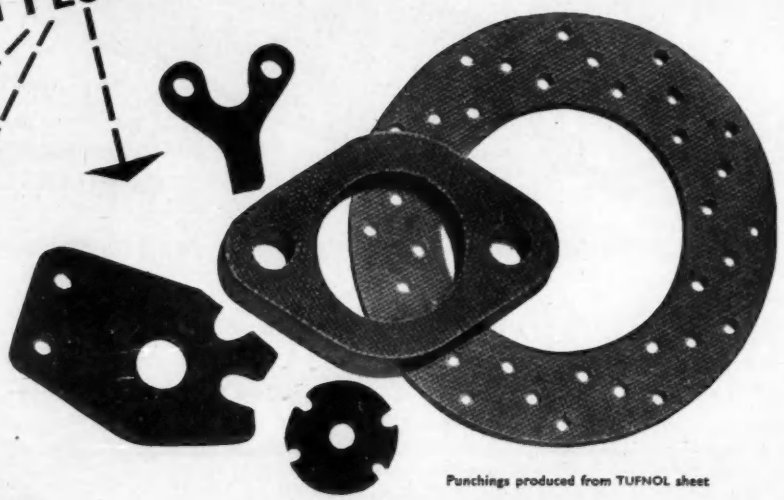

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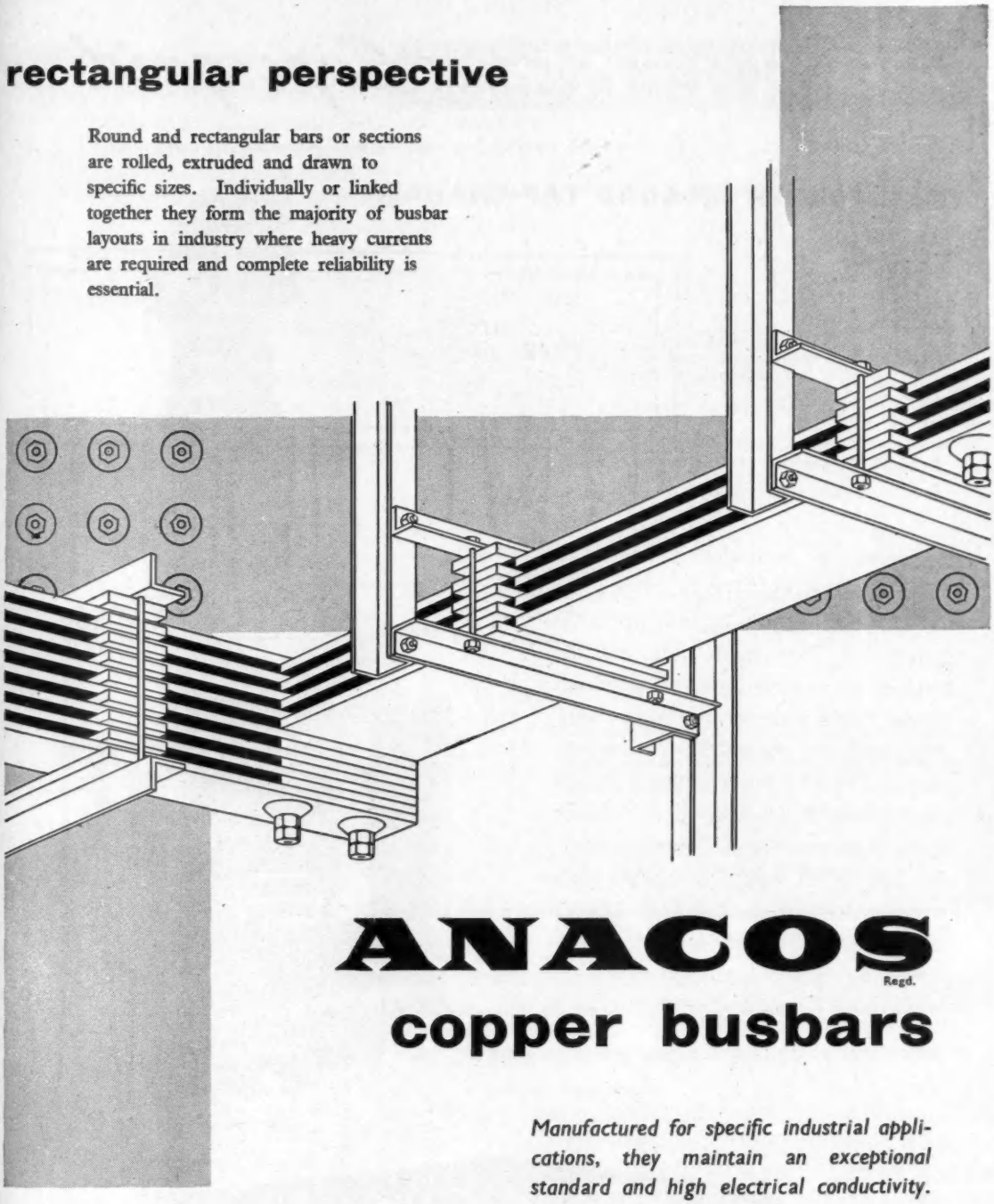

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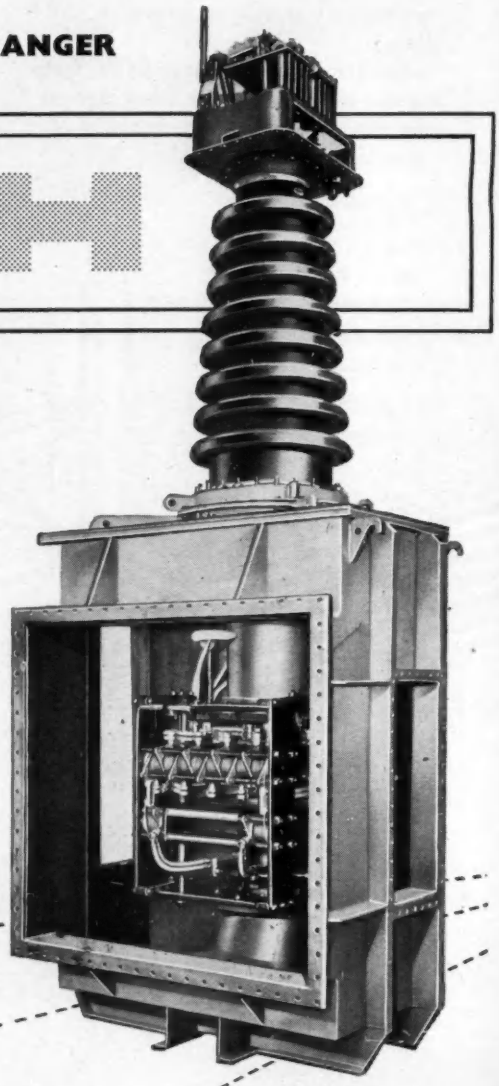

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27 JUNE
1958

ELECTRICAL REVIEW

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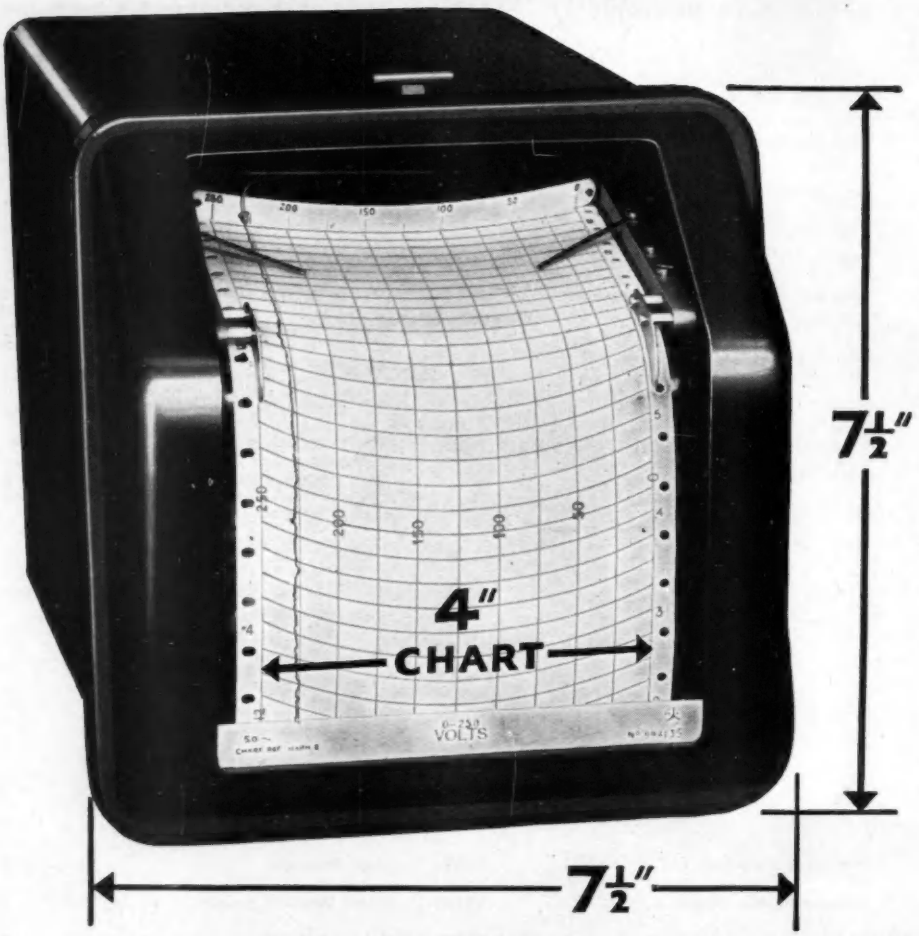

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ELECTRICAL REVIEW

27 June 1958 Vol. 162 No. 26 Established 1872

A Regrettable Necessity

UNTIL last week Great Britain was able to claim to be the only country whose programme of development of nuclear power was designed solely for civil purposes; now, for defence reasons, the Government has decided that all but the first two of the new stations must also be a source of plutonium for military purposes. The decision must be accepted, although it is unfortunate for several reasons. It seems almost inevitable that it will result in higher cost of the electricity produced, for it reduces the "burn-up" period of the uranium fuel elements when the aim has been to extend that period and thus get the most out of the fuel. What the extra cost will be is not easily calculable without data which is not available but various estimates, ranging from £12 to £15 million per annum for each station, have been made. Against this must be set any contribution made from defence funds and it may be that the amount will be sufficient to meet the extra cost. It has been suggested that considerable extra capital costs will be required for extensive alterations to the plants. The question is reviewed by a qualified correspondent in this issue and we gather from his survey that although some alterations in the original designs will be called for, it is unlikely that these modifications will be very serious. It is, however, certain that some loss of electrical efficiency and a lower electrical output from each station will result, although these will be offset to some extent at least by the financial gain from the sale of the additional plutonium. A rough measure of these losses can be obtained from the operating results of the Calder Hall power station as far as they are known and these do not point to any very great disturbance of existing calculations, although it must be borne in mind that whereas the first call on the Calder Hall power station is for plutonium, the primary function of the new public supply stations will be to supply electricity.

The Ministry of Power has impressed upon us the importance of making it clear that the civil stations will be equipped to yield additional plutonium only if it is required, and that normally the operation of the stations will not be affected.

But it must still be the case that stations employed for the dual purpose of power and plutonium production are likely to have lower overall efficiencies and it will be very difficult to assess how much of the reduction is attributable to their secondary function. This may prove a serious handicap when it comes to quoting for stations overseas, although, of course, the Bradwell and Berkeley plants will be able to provide "pure" power statistics.

OFF-PEAK TARIFFS

There is a tendency for many people to believe that the load curve could practically be levelled out if suitable off-peak tariffs were offered by the Area Boards. But some speakers at the B.E.P.C. Forum last week were very doubtful whether such tariffs would make a tremendous difference. Mr. A. R. Cooper, for instance, thought that as the cost of electricity formed such a small proportion of an industry's total costs, as a rule, a special tariff would not be much of an inducement to firms to run three-shift systems. Sir John Hacking considered that, with the need to make full use of plant, industries employing automation would improve their load factors without requiring any tariff inducement.

It was most interesting to hear Sir Claude Gibb say that his own company's arrangements were such that the works had a day load of 10 MW and a night load of 15 MW. The poser of this particular question had suggested that there should be some inducement in the bulk supply tariff, but Sir Christopher Hinton said that this tariff should be such as to spur the Area Boards to improve their load factors. But surely the present form is designed to have this effect.

TOO SUPERIOR?

Can electricity showrooms be too elaborate? There are many people outside the industry who talk of the unnecessary expenditure upon these establishments, but if they are worth doing at all they should be well done. Nevertheless it was suggested by one or two speakers at the B.E.P.C. Forum that if the service centres are too "superior" (Sir Christopher Hinton used the colloquial "posh") they may frighten people away. Sir Christopher said that he felt that in some of these showrooms he could not possibly spend less than about £30; for his smaller wants he went elsewhere.

Mr. A. N. Irens (chairman of the South Western Board) said that his Board got over that sort of feeling by having what they called "Woolworth counters" in their service centres on which they displayed the smaller and cheaper appliances and fittings. We doubt whether this is really a serious problem. If the showrooms are made to conform with the character of their neighbourhoods, with just a little "superiority," the Boards cannot go far wrong.

THE ENGINEER AND MANAGEMENT

So much has been said and written during the last few years about the qualifications of engineers for the higher managerial posts, arising largely out of the efforts to recruit more and more technologists and technicians into industry, that the theme is tending to become commonplace. But we feel bound to recommend Mr. S. Winstanley's presidential address at the recent convention of the Association of Mining Electrical and Mechanical Engineers to every existing and potential engineer and manager, to all concerned with recruitment to the engineering professions, to all educationalists and, above all, to university students and technical college students.

Throughout his training and subsequent experience of engineering works, circumstances force the engineer to be "cost conscious." Considerable attention is devoted to teaching him how to make an economic choice from alternatives and thus he can justly claim to have acquired the idea of value for money, one of the essentials for management which Mr. Winstanley cited. Others were basic specialised training and qualifications; talent for leadership; ability to make decisions; and possession of the commercial instinct.

We suspect that behind Mr. Winstanley's theme was the suggestion that on the whole the engineer does not get the chance which is his due when appointments to managerial posts are under consideration.

INSTALLATION FAULTS

If any reminder is needed that the electrical installation business is one which only intelligent, skilled and experienced people should take up it comes in the form of a publication "Common Installation Faults" issued by the National Inspection Council for Electrical Installation Contracting. All contractors accepted for enrolment by the Council are required to conform in their work to the I.E.E. Regulations and the booklet takes a number of the most important regulations and details the breaches which are too often discovered on inspection. Many of the faults are seen to be the result of carelessness or perhaps price-cutting, but others are of a technical nature, showing neglect or inability to read or interpret the regulations properly.

The booklet should form a useful corrective to those contractors whose work or supervision is lax. There is already evidence that the Council's operations are becoming increasingly effective in raising the standard of installation work and this publication should make a useful contribution.

DIRECT NUCLEAR HEAT

There is an announcement in this issue of the placing of an order for a "package" nuclear reactor for operation in Alaska. This plant will have a dual purpose in that half of its thermal output will be directed to the generation of electricity while the other half will be used directly for space heating. This is the first time we have heard of the direct use of the heat from a reactor.

This is particularly interesting because, as we have indicated on previous occasions, it has always appeared to be a rather tortuous path to generate heat from electricity and then, in turn, use the electricity for heating. We think it very important that the possibility of the more direct use of energy from the nuclear reactor should be borne in mind by electricity supply men.

ELECTRIC FIRES

Some 400 models are listed in the illustrated survey of domestic electric fires to be published in next week's issue of the *Electrical Review*. Particulars, given in tabular form, will include type, loading, elements, finish and price, with the new rates of purchase tax. Low temperature heaters will be reviewed in our 18th July issue.

Missile Guidance Systems

OUTLINE OF VARIOUS TYPES

By R. L. HUGHES, B.Sc., A.M.I.E.E.*

PRESENT-DAY defence problems have led to the development of guided missiles to meet the stringent requirements of modern warfare. For example, the increasing speed and ceiling of modern aircraft put the task of interception outside the capabilities of an unguided projectile such as a shell from an anti-aircraft gun, which would need to be launched with great accuracy and fly at enormous speed to achieve a hit on a high-altitude supersonic aircraft. A guided missile flying at only moderate speed can, however, be used successfully. This is because it is supplied with, or can obtain for itself, continuous steering signals to direct it towards its target. Guidance information can be derived in a variety of ways and the method of derivation serves to classify the guidance systems.

Phases of Missile Flight

The flight of a missile can be conveniently divided into the launching phase, the mid-course phase and the terminal phase. The launching phase is usually shortest in duration and covers the period during which the missile is being accelerated to its cruising speed. Guidance during this time is of a limited form and in many cases is not even attempted. In the mid-course phase the missile may be sustained at cruising speed or allowed to coast. Guidance during this phase can, in many applications, differ from that employed in the terminal phase; it generally involves the use of remote target and missile tracking and the passage of information to the missile by link. This corresponds to the phase in the control of a manned fighter aircraft when it is being "vectored" to intercept its target. The terminal phase on the other hand relies to a greater extent on missile-borne equipment and may be quite independent of remote target tracking. This phase culminates in the detonation of a warhead in close proximity to the target. In short-range missiles the mid-course and terminal phases are indistinguishable, the guidance being of one form for the whole flight.

In a command guidance system both the target and missile are observed from a remote point either optically or by radar and the missile is directed to intercept its target by intelligence conveyed along a wire or radio command link. Such systems vary in complexity from the short-range wire-controlled anti-tank weapon employing optical tracking by a human operator to the mid-course guidance of a long-range missile where radar tracking and radio links are employed. The latter system must be capable of continuous computation of the steering orders to eliminate the need for a human operator in the control loop. The disadvantages of command systems include their inability to cope with several missiles at one time and their vulnerability to counter-measures. The missile-borne equipment, however, is not excessively complex, consisting essentially of a multi-channel radio receiver and a servo-mechanism for the movement of aerodynamic control surfaces.

* Applied Electronics Laboratories, The General Electric Co., Ltd.

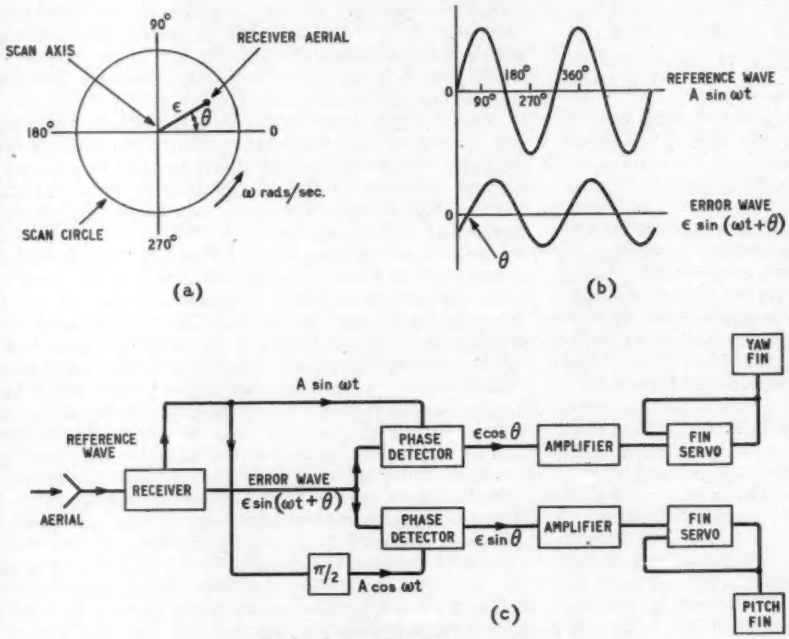


Fig. 1.—Beam rider guidance receiver

(a) Locus of beam-tip in plane of receiver
(b) Reference and error waveforms
(c) Beam rider guidance receiver block diagram

Beam Riding

The first essential of beam rider guidance is a radar system capable of accurate automatic tracking of a target. The missile is launched into the radar beam and guides itself along the axis, using a rearward-looking aerial and guidance receiver to detect the magnitude and direction of any deviation from the centre

of the beam, and deriving steering signals to operate the control surfaces and so correct for this deviation. One method of accomplishing this involves the use of a conically scanning radar beam, the focus of whose tip is a circle in a plane normal to the beam. An aerial located in this plane and close to the beam axis will receive a signal whose amplitude is modulated at the scanning rate. The magnitude and phase of the demodulated envelope give the position of the receiving aerial, and hence of the missile, with respect to the beam axis. To ensure correct sensing of this signal it is necessary to add a reference signal to the radar transmission which is synchronous with the beam rotation and the receiver must be capable of separating it. Roll stabilisation of the missile is also necessary to ensure that the reference planes of missile and radar beam do not become inclined. Fig. 1 shows the essentials of a beam rider guidance receiver, with some idealised modulation and reference waveforms, and their interpretation in terms of angular error.

Beam riding can be used as mid-course guidance with a different form of guidance during the terminal phase or, in shorter-range missiles, beam riding can take place for the whole of guided flight. As the launching range is increased in such systems so the miss-distance between missile and target will increase due to target tracking and beam riding inaccuracies, and this sets a limit to the useful maximum range. As the range increases, the need for a

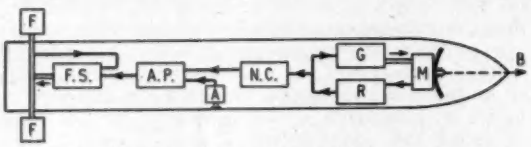


Fig. 2.—Interconnections in a missile control system

B. Radar beam direction
M. Microwave aerial system
G. Reference gyroscope for aerial stabilisation } Homing head
R. Radar receiver
N.C. Navigation controller
A. Accelerometer measuring pitch or yaw acceleration
A.P. Autopilot
F.S. Fin control servomechanism
F. Fin, or control surface

target-tracking system carried in the missile becomes apparent and systems such as the following become necessary.

Passive Homing

The term "homing," as applied to a guidance system, describes any form of guidance in which information about target movement is gathered by the missile itself. Unlike the beam rider, this involves the installation of a forward-looking detection device such as a radar aerial. Such an aerial must be mounted in a gimbal system so that it can point at the target over a range of angles of look. The purpose of the tracking signals derived from a homing eye is to keep the aerial trained on the target, and to provide the missile control equipment with steering signals so that it may be navigated to the target.

Passive homing relies on there being some form of detectable activity on the part of the target, such as the infra-red energy radiated from an aircraft engine. A missile using this form of homing is fitted with a highly directive mirror system in its nose focusing the received radiation on to a photocell. It is then possible to extract target movement relative to the missile from the electrical output of the cell after suitable amplification. Any other form of radiation emanating from the target can be treated in a similar way provided it can be distinguished from the general background and that propagation does not deteriorate markedly in, for instance, conditions of poor visibility. The radiation must not in itself be so directive as to confine attacks to impossibly narrow sectors, and the intensity must be such as to provide adequate missile range. Clearly, the missile detecting equipment must be extremely sensitive and highly selective to exploit any such system fully.

Fully Active Homing

A fully active homing missile carries in it a means of illuminating the target and receiving the re-radiated energy. This can be achieved by a microwave radar transmitter-receiver employing a directional aerial system mounted in the nose of the missile. Such a scheme can be used in the terminal guidance phase only or it can be used during the whole of flight, when it is termed "homing-all-the-way." In the latter case the method of operation starts with the detection of a target by a powerful search radar which may itself be airborne. When the target has been identified, the radar commences to track it in the manner of a fire control system and the missile aerial system is trained on to the correct bearing and elevation.

Once the target has been detected by the missile, the latter is launched on an interception course, its aerial system keeping the narrow beam on the target. This automatic following technique requires the use of a servo-loop in the missile incorporating an aerial system which is stabilised by a gyroscope against motions during flight. The missile radar receiver forms the major part of this loop, detecting target angular movement from the modulation on the signal returned from the target, and providing precession signals for steering the aerial system, and guidance signals for the control of missile flight. The radiated energy may be transmitted in discrete pulses or continuously. In the pulse radar system, target range is measured by the time delay between transmitted and received pulses, while in the continuous wave system ranging is possible if the transmission is frequency modulated. It is also possible to employ the Doppler principle to measure the velocity of the target relative to the missile in terms of the frequency difference between transmitted and received radiation.

Figs. 2 and 3 show the interconnections in a missile control system and the outline block diagram of the guidance system of a fully active homer respectively. Conical scanning is frequently used to obtain target angular information, the received signal being amplitude-modulated at the scan frequency when the target lies off the axis of the scanning beam. The angle tracking loop, a position control servo-mechanism, minimises the angular error between the radar beam axis and the sight line between the missile and target. The magnitude of the angular error is proportional to the depth of modulation on the returned signal, while the phase of the modulation with respect to a reference wave, synchronous with the conical scan generator, is indicative of the sense of the error. The angle tracking loop measures the angular rate of turn of the sight line to the target and conveys this to the missile auto-pilot, which computes and demands the necessary accelerations required of the missile.

Target ranging can be carried out in a pulse radar by means of a closed loop system in which an internally generated strobe pulse is kept in time-coincidence with the received target pulse. Alternatively, target velocity can be tracked by generating a velocity strobe and keeping this in frequency coincidence with the Doppler shift due to the target-missile relative velocity. In either case, a first or second order servo-loop can be employed. In addition to these control loops it is necessary to include

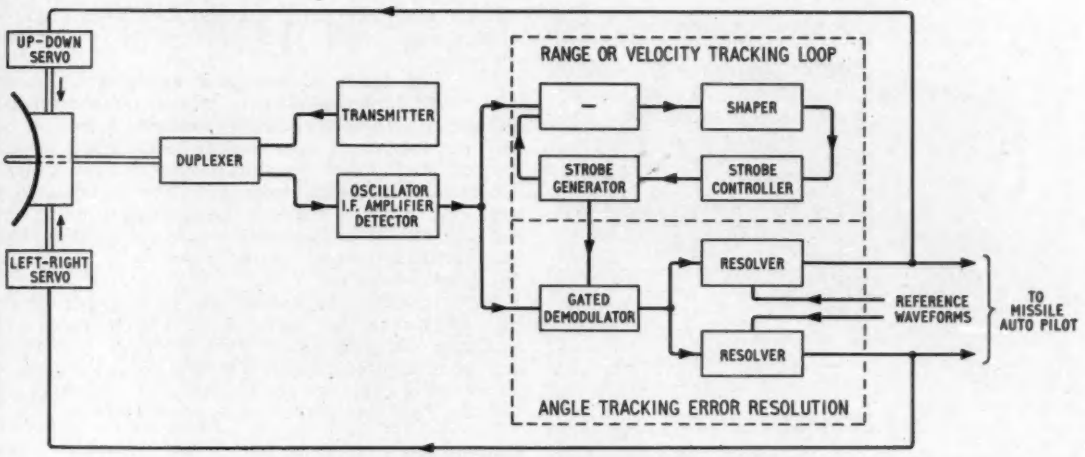


Fig. 3.—Block diagram of the guidance unit of a fully active homer

an automatic gain control loop to allow for the change of signal strength between extreme target ranges, and frequency control loops to compensate for thermal drift of oscillators, and to remove frequency modulation due to vibration and other causes.

The fully active homer is capable of reaching its target without external assistance once it has acquired the target. The missile-borne equipment required to do this is necessarily heavier and more complex than, for instance, that of a beam rider.

Semi-Active Homing

A semi-active homer relies on an external radar transmitter for target illumination. The block diagram of the guidance unit of such a system is similar to that of the fully active homer with the transmitter and duplexer removed. One property of such a system is the dependence of the missile on its launcher during flight. In the case of an air-launched weapon this might place an unwelcome restriction on the post-launch manœuvre of the launching aircraft which, in keeping its illuminating radar beam on the target, might be uncomfortably close to its target at the instant of impact.

Inertial Guidance

An inertial guidance system, unlike the homing and beam riding systems, does not require for its operation the radiation of energy from the target or elsewhere. Such a system finds application in long-range ground-to-ground missiles where it is used for great circle navigation between two known points on the earth's surface.

An inertial-gravitational guidance system obtains its guidance information from the earth's gravitational field by using a vertical sensing unit to measure the direction of gravity continuously during flight. The error between this and a required field direction is used to demand a steering signal. The target position is defined since the direction of gravity is unique at any point on the earth's surface. A gyro-stabilised platform is used to provide a space reference.

Inertial-celestial guidance systems employ gyro-stabilised star trackers which automatically track stars in rather the same way as a homing missile aerial is made to track a target. A succession of fixes is obtained from the simultaneous observations of the stars and the position of the missile is compared with one which is predetermined. Steering signals are derived from the difference between observation and prediction to give continuous course correction. On arrival near the target after great circle navigation by inertial guidance some form of homing may be resorted to in the terminal phase.

Radio Navigation Systems

The radio navigation systems familiar in ship and aircraft navigation can be used to provide two-dimensional guidance information for the mid-course phase for ground-to-ground missiles. A typical system involving the hyperbolic navigation technique uses a master transmitter and two receivers in the missile and two ground-based transponder beacons which re-radiate a signal to the missile when interrogated by the missile transmission. The signals from the two beacons are compared in the missile and the time difference between them compared with a predetermined value. Any error between measured and predetermined values is indicative of an error in the missile track, and corrections are continuously computed and used to steer the missile along a hyperbola, which is the line of constant range difference between the two transponder beacons at the foci of the curve. One unique hyperbola with these foci passes through the target. The missile control system thus seeks to keep the time delay between the beacon signals at the value corresponding to this hyperbola. A radio altimeter is used in conjunction with an automatic pilot to keep the missile at constant height.

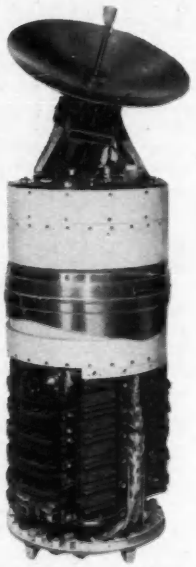


Fig. 4.—Experimental missile homing head

In the electronic circuits which form a large part of the control equipment of a guided missile electrical power is often provided during flight from a speed-regulated turbo-alternator, usually driven by compressed air. In the larger missiles several kilowatts of electrical power are generated at

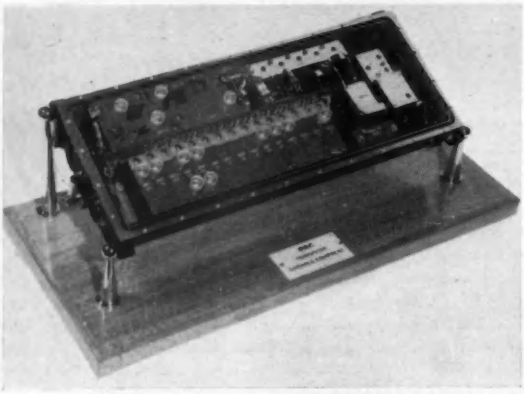


Fig. 5.—Transistor guidance equipment

frequencies ranging from a few hundred cycles to a few kilocycles. The advantages of high-frequency supplies lie in the use of smaller wound components and smaller smoothing components. Hydraulic or pneumatic actuation of the aerial system and control fins call for the provision of high-pressure supplies. A supply of coolant may also be necessary to remove the heat dissipated in small high-power components.

The conditions occurring during flight give rise to many problems in the design of missile-borne guidance equipment. High levels of vibration necessitate the use of special quality thermionic valves of rugged construction. Encapsulation of wiring and components may also be necessary. The immunity of transistors to microphony, together with their small size and low power requirements, make them particularly suited to missile application.

The high levels of sustained acceleration during boost and during manœuvre impose quite stringent requirements on rotating mechanisms which have to be very well balanced. High hot-spot temperatures associated with small wound components call for the use of high-temperature insulating materials. The comparatively small space available demands close packing of equipment and introduces a cooling requirement, particularly when long pre-flight running of equipment is necessary for testing and adjustment.

Fig. 4 shows a radar homing head for a guided missile from which some idea can be obtained of one method of packaging electronic units. Printed circuit techniques and sub-miniature components are widely used and Fig. 5 shows part of a guidance unit incorporating transistors and magnetic amplifiers and employing printed wiring.

Conclusion

Missiles may be guided over a vast span of distance from the few hundred yards of a wire-controlled weapon to the thousands of miles covered by an inter-continental missile. The choice of guidance systems is closely linked with such factors as the required range, the form of target, the maximum radar range achievable against a given target, and the accuracy required. The launching platform may be land-based, ship-borne or airborne and the target may be on land, or sea or in the air. Thus, many combinations of launcher and target are possible, and the application of numerous and varied skills and techniques in the aircraft and electronic industries is involved in the solution of the problems of missile design.

E.R.A. REPORTS

Amorphous Dielectrics.—Report Ref. L/T263, "Effect of the Cathode Material on the Breakdown Strength of Amorphous Dielectrics," by J. J. O'Dwyer (price 6s), deals with the intrinsic breakdown strength of amorphous dielectrics which has been calculated by Frohlich on the basis of a fairly general model of an amorphous dielectric. Using this model, it has been shown that the intrinsic breakdown time should be less than 10^{-10} sec for almost all substances of this type. The purpose of the investigation, carried out at Liverpool University, is to interpret breakdown in the light of the above theory with particular reference to cathode material.

Ignition of Methane-Air Mixtures.—Ref. D/T105, "The Effect of Circuit Resistance on the Discharge Energy Required for the Ignition of Methane-Air Mixtures," by H. G. Riddlestone (price 7s 6d), describes the continuation of investigations on the ignition of an 8·3 per cent methane-air gas mixture by capacitive discharges in circuits of variable resistance. An earlier report, Ref. G/T304, described the effect of series resistance on the critical stored capacitive energy required to ignite the gas mixture and the actual discharge energy has now been measured for the same critical circuit conditions. The method of measurement used was that given in a previous report, Ref. G/T293, with values of circuit resistance up to 25,000 ohms.

Ionising Radiation During Spark Discharge.—Report Ref. L/T349, "The Emission of Ionising Radiation During a Spark Discharge," by W. A. Prowse and G. R. Bainbridge (price 12s 6d), describes how a high-voltage pulse lasting 0·35 microsecond is applied to two delay lines so that two pulses can be picked up from adjustable points of connection on the lines. One is applied to an irradiating gap and the other to a longer gap, the gaps being arranged so that only mid-gap irradiation takes place. The sparking probability, P, of the test gap is used to indicate the presence of ionising radiation. Variations of P with the time interval between the two pulses are recorded. They indicate that ionising radiation is emitted in repeated short flashes, and photographic observations support this view. Some measurements of the absorption coefficients of the ionising radiation are recorded.

Dielectric Properties of Nylon.—Investigations carried out at the National Physical Laboratory on the dielectric properties of pure nylon and of nylon containing 0·3 per cent titanium dioxide filler over a frequency range of 60 c/s to 36×10^9 c/s and over a temperature range of −80 to +170 deg C are described in report Ref. L/T355, "The Dielectric Properties of Nylon," by E. Rushton and G. Russell (price 10s 6d). It was found that the addition of the filler had practically no effect on the dielectric behaviour. The behaviour of the nylon is complex, due presumably to the number of different polar groups in the molecule, and the results suggest that several loss mechanisms are at work.

One process gives rise to absorption effects at room and low temperatures and another to larger effects at high temperatures of the order of 100 deg C, and at still higher temperatures (130 deg C and upwards) the conductivity of the material becomes relatively high.

Copies of the above publications are available at the prices indicated in parenthesis from the E.R.A. at Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

VIEWS on the NEWS

By REFLECTOR

BRIGHTON is a very large town and when a great horde of visitors is added to the local population there are naturally traffic problems of a considerable magnitude. It seemed to me last week that the authorities there were a little more lenient towards motorists than the Metropolitan Police can afford to be. A sidelight on the problem was given by the Mayor of Brighton at the Power Convention dinner. He said that the Corporation Watch Committee had spent three weeks discussing the arrangements for dealing with the very many cars of Convention delegates, only to find at the end of their deliberations that another committee had allocated most of the largest central car park to the Exhibition. Still, room seems to have been found for all, at the owners' risk. One well-known electrical contractor found that his car had been borrowed. It was discovered by the police some hours later a few miles away.

* * *

Sir Christopher Hinton, the chairman of the Central Electricity Generating Board, can be relied upon for telling aphorisms. Speaking at Brighton last week on the subject of railway electrification, he said:—"When it is known that a certain development is ultimately inevitable there are sometimes good reasons for carrying it out in advance of its absolute justification."

* * *

The Town Clerk of Inverness has, I see, taken up a remark by the chairman of the Scottish Special Housing Association in which he referred to Kirkcaldy Town Council as having "given local authorities a splendid lead with their blocks of all-electric flats." Writing in *The Scotsman*, he points out that the building of flats with underfloor electric heating at Inverness was sanctioned in September, 1952, and was begun soon afterwards. Kirkcaldy Corporation, in fact, had sent representatives to inspect them before embarking on their own scheme. Reference to the files of the *Electrical Review* shows that the northern town were certainly pioneers in this field and credit should be given in particular to the burgh architect, Mr. J. Blackburn, who before the flats were constructed designed and built for his own use the first of several privately owned houses in Inverness equipped with floor warming.

* * *

Company histories tend to be a rather monotonous record of unbroken progress punctuated by descriptions of the various types of equipment and apparatus that have been successfully developed and marketed. There is no mention of the inevitable failures.

It is refreshing to find, therefore, that the Electrical Apparatus Company in the brochure celebrating their golden jubilee have had the courage to include details of some ventures that did not come off. Readers familiar with the company's present range of products may be surprised to learn that in the early days of broadcasting the company started a new line of variometer-type crystal wireless sets, although not more than a thousand were produced. This venture was followed by the construction of a two-valve receiver, but here again comparatively few were made. Another device that failed to attract the market was an electric massage instrument, not much bigger than an electric razor, which bore the trade name of "Zodiac."

* * *

The electricity supply industry, in common with other branches, is striving to secure the right sort of young man for its future operation. In this connection the Merseyside and North Wales Electricity Board has prepared a booklet called "Careers in Electricity—Planning a Career with MANWEB." This describes in glowing terms the opportunities offered to ambitious and capable boys. The Board's magazine, *Contact*, says that the theme running through the booklet is: "Hidden in every apprentice's toolbag lies the key to a Board Chairman's office." It would be as well not to take this variant of the field marshal's baton too literally, I think.

* * *

In the *Manchester Guardian's* "Miscellany" the new system of telephone charges is discussed and the writer says:—

> "With calls charged on a basis of time and distance it seems strange that while gas and electricity suppliers are compelled to provide the customer with a meter on his premises the post office will insist on a charge of £1 a quarter for those who demand it. One suspects that the charge is designed to cover the cost of the ensuing arguments."

Presumably the cost of arguments about the readings of gas and electricity meters is borne by the undertakings.

* * *

An item of interest in the *Electrical Review* of 26th June, 1908, was an announcement of the proposed acquisition by the Institution of Electrical Engineers of the building which is now its headquarters. Known as the Medical Examination Hall, it was owned by the two Royal Colleges of Physicians and Surgeons who held it from the Duchy of Lancaster on a 99-year lease dating from 1885. The Council of the I.E.E., it was stated, proposed to purchase this lease for £50,000, plus the ground rent of £2,201 per annum. A photograph of the building was reproduced and the *Review* observed that its situation was all that could be desired on the score of accessibility and environment and the building "appears to be admirably adapted to the purpose of a home for the hitherto nomadic Institution." The purchase of the building was completed on 1st June, 1909, and on 10th November, 1910, after structural alterations to the lecture theatre had been completed, the Institution, for the first time, held an ordinary general meeting in its own home.

Smoke from Power Station Chimneys

Some Observations Arising out of the Clean Air Act

By H. E. CROSSLEY, B.Sc.Tech., M.Sc., Ph.D., and G. ENGLAND, B.Sc.(Eng.), A.M.I.E.E., A.M.I.Mech.E.

ON 1st June this year the main provisions of the Clean Air Act were implemented, and particular interest will be centred on the regulations limiting the periods for which dark smoke may be emitted from industrial plants. The co-ordinated electricity generating industry has been, from its inception, fully conscious of its responsibilities for ensuring that power stations shall be operated with the minimum contribution to atmospheric pollution, and the main purposes of this article will be briefly to review the general position in the industry before vesting day and to indicate the range and extent of the various measures which have been taken since the setting up of the British Electricity Authority in April, 1948.

In this article the same interpretation is given to "smoke" as in the Clean Air Act; that is, it will be used to refer to soot, ash, grit and gritty particles emitted in chimney effluents. The problems concerning power stations are only to a very limited extent concerned with sooty smoke. Soot is an indication of incomplete combustion, and elaborate measures are taken in all power station boilers to ensure that combustion is complete. These measures cannot be fully effective during the early stages of lighting-up a boiler, but with the stabilisation of combustion, soot is an extremely rare constituent of power station chimney gases. Although the emission of dark smoke is concerned mainly with the lighting-up period, this period is necessarily more protracted with power station boilers than with smaller industrial plant because of the considerable heat capacity of the large water-cooled combustion chambers used in modern power station boilers. Steps are, however, taken with pulverised-fuel firing to reduce the lighting-up period by using liquid fuel. During normal operation the gases discharged from the power station chimneys are much lighter than shade 2 on the Ringelmann chart which is used in the Clean Air Act as a measure of dark smoke.

Conditions Before 1948

In the ten years preceding the war the electricity generating industry developed rapidly, with the construction of bigger and more efficient power stations operating mainly with various types of mechanical stokers. During that decade, the amount of coal burnt as pulverised fuel showed a marked rise, although pulverised-fuel fired boilers were still playing only a minor part.

The awareness of the public and industry of the importance of atmospheric pollution in national life was hardly awakened in pre-war years, but the problem had received serious attention by those responsible for the management of power stations. As long ago as 1930 the Electricity Commissioners appointed a special technical committee which made a study of dust and grit from power stations and issued a report with recommendations in 1932.

In that decade mechanical dust collectors were used for arresting dust from stoker-fired boilers. Although the efficiency of such collectors improved steadily during this period, it must be admitted that there were limitations to the technical knowledge available. For example, the first recognised Code of Practice in Great Britain for the determination of efficiency of such collectors was issued as a British Standard Specification only in 1940 (B.S. 893). Similar limitations applied to the development of electrostatic precipitators, used for arresting the finer dust emitted from pulverised-fuel combustion. It was clear at that time to many people that there was a great need for technical knowledge to assist in the development of dust-arresting plant.

It had been appreciated for a long time that a high chimney was better than a low one for the dispersal of chimney emissions, and a major step was taken by the Electricity Commissioners, who recommended that in future the height of power station chimneys should be not less than 2½ times the height of the highest point of the generating station buildings. It is a great tribute to the work of the committee that although there is now a considerable amount of information on this subject, their general rule is still a useful guide to-day.

Summing up, therefore, the period of rapid development in the decade ending in 1939 showed that, although handicapped by a lack of technical knowledge, generating authorities were anxious to operate power stations without detriment to the public.

In the war years 1939-1945, there was little opportunity for scientific development in the heavily burdened electricity generating industry. The main problem facing the industry in 1945 and for several years after was to generate the electricity so badly needed nationally, with a steadily growing deficit of available plant. The scope for applying scientific knowledge to emission problems increased with the full co-ordination of the industry in 1948.

New Power Stations

In the planning and designing of new power stations the siting of the station, the design of the plant items which determine the quality and nature of the emission and the measures taken to disperse the emission, all contribute to cleaner air. These three factors are interdependent and cannot be treated in isolation if the best results are to be obtained from the available technical and financial resources.

From the early investigations of a new site the problem of emissions is in the forefront and the Central Electricity Generating Board, which is concerned with sites in the whole of England and Wales, is able to make use of wider experience and of more specialised investigations than the former local supply undertakings. When potential sites are considered, attention is given to the environment, to ground contours and the frequency of occurrence of various winds. This does not mean that a clear priority can be given to consideration of emissions, compared with other factors. It does, however, mean that the problem is studied at the outset and a site is adopted only if those responsible are satisfied that the flue gases can be discharged without objectionable effects.

The fundamental starting point for the design of the plant is the nature of the coal to be burnt. The Board maintains close consultation with the National Coal Board about long-term supplies and future trends in the sources and qualities of coal likely to be available for electricity generation, and new plant is designed from the best avail-

able forecast of the coals to be supplied. This is particularly important as it is the role of the electricity supply industry to burn the lowest grades of coal in plants designed to do this with minimum smoke emission, so relieving industry of some of its operating problems. Almost all new stations have been designed for pulverised-fuel firing and the first items of plant within the station, which directly affect the emissions, are the pulverising mills. The Board has adopted the practice of specifying milling plant with a margin of capacity which enables systematic maintenance to be done, even when a station is meeting a heavy demand, thus giving a greater assurance that a high standard of grinding can be maintained.

Recent advances in boiler design, by achieving higher combustion efficiencies and more consistent combustion conditions, assist in limiting solid emissions, and there have also been notable advances in the understanding of dust-collecting phenomena and in the technique of measurement of dust burdens. The Board has conducted a good deal of research into these problems and has co-operated with other research bodies. The increased knowledge has led to improvement in the specification and the selection of dust-collecting plant. No longer is the guaranteed performance of an arresting plant tied to a single efficiency figure which can only apply to limited operating conditions. Current specifications call for performance data over a full range of dust burdens, gas velocities and temperatures likely to occur with the expected range of fuels.

A guaranteed efficiency is not all that is required. It is also essential to sustain optimum performance and high availability under normal service conditions and the progress that has been made in developing remote and automatic controls for electrostatic precipitators has made its contribution. In a typical modern station, over the whole range of operating conditions, 98 per cent of the dust which leaves the furnace will be caught by the arrestors.

The dispersal of the remaining dust from the chimneys depends on meteorological conditions and on the way in which the flue gases are discharged. The most important single factor in preventing local nuisance is adequate chimney height. The chimney must in any case take the flue gases clear of the disturbance in air flow due to nearby buildings, which is the objective of the "$2\frac{1}{2}$ times rule," but the trend in the supply industry is towards even higher chimneys. Tall chimneys are, however, a hazard to aircraft and where stations are sited away from urban areas there is sometimes a conflict of interests.

Higher efflux velocities are also being adopted to improve the dispersal of emissions. Precise evaluation of the gain in effective chimney height is difficult, but direct observation of plumes shows the value of a high efflux velocity in getting the plume cleanly away from the top of the chimney. Stations which are now operating mostly have full-load efflux velocities in the range of 20-30 ft/sec. Stations being designed to-day generally have efflux velocities of 50 ft/sec and, in special cases, this has been increased to 70 ft/sec.

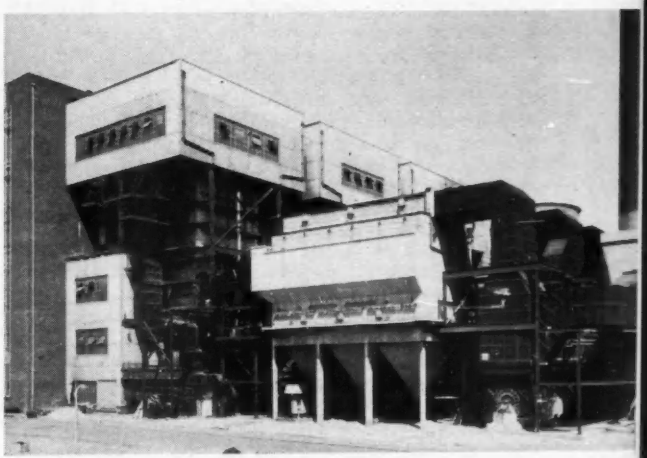
The buoyancy of the flue gases due to their high temperature compared with the surrounding air is of the greatest importance in determining the path of a plume. The effect is very noticeable in still air conditions when a hot emission rises in a compact plume to many times the actual chimney height. In "smog" conditions when there is most public anxiety about the effects of chimney emissions, buoyancy, coupled with the tall chimney and the high efflux velocity, is particularly important. Except where flue gas washing is installed, the design temperature of gases leaving the coal-fired power station chimney is in the range 250-280 deg F, but any increase in temperature can be obtained only at the expense of thermal efficiency. The maximum buoyancy effect is obtained when a large volume of gas is discharged from each chimney. Before the war power stations were much smaller in capacity than those recently constructed, and chimneys designed for the emissions from 60 MW of plant were common; the largest chimney so far brought into service deals with 210 MW and the largest so far planned will deal with 550 MW.

Field Investigations

Great Britain is unique among the countries of the world in having a co-ordinated survey of atmospheric pollution on a national basis. This was promoted by the Department of Scientific and Industrial Research and is supervised by the Fuel Research Station. Since 1948 it has been the policy of the electricity generating industry to survey the extent of atmospheric pollution at ground level around all new power stations, the survey beginning at a minimum period of two years before commissioning and continuing for a period of at least two years after the full commissioning of each station. Nationally, the total number of measurements made monthly by local authorities and others to indicate the deposition of dust is now 1,095, and of this total 273 are made by the C.E.G.B. The Board has separately collated its own results, and a paper has been published summarising the position up to the end of 1956,[1] and giving a completely satisfactory report on the behaviour of modern power stations. It is noteworthy that in rural districts considerably greater dustfall has been found to be due to agricultural operations than to the nearby power station, and the general character of the district has in no way been changed by the commissioning of the power station.

More detailed information was sought by an intensive survey of atmospheric pollution around Little Barford power station which is situated in open country. The results of this investigation have been published[2] showing that although the emission of dust from the station was greater than it would be in the case of a more modern

[1] W. D. Jarvis and L. G. Austin, J. Inst. Fuel, 30, August, 1957, 435-446.
[2] G. England, C. J. Crawshaw and H. J. Fortune, J. Inst. Fuel, 30, September, 1957, 511-519.



An electrostatic precipitator installation associated with a 60 MW semi-outdoor boiler

station, the deposition of dust in the district was so small as to be hardly detectable.

Older Stations

Owing to the shortage of plant capacity, it has been necessary to continue operating some relatively old plant and, of course, most of the plant installed in the years immediately before 1939. The oldest plant is now required only at times of emergency when there is a risk of shedding load unless all available capacity is used. This results in an extremely low load factor in such cases, and the consumption of only a very small quantity of fuel per annum. The usage of these stations still declines, and each year it becomes possible to close down some of the most costly, where alternative supplies can be made available. Even the plant installed in the few years prior to 1939 has to-day a low load factor in most cases and, perhaps still more important, it is rarely necessary to overload boilers in these older stations, as was unavoidable during the war years and immediately after. For these reasons, although the provisions made to minimise atmospheric pollution in older stations were not as effective as are now made, the *national* significance of these sources is relatively small. In special local circumstances it has been found possible to bring up to date the dust-arresting plant or to build a tall chimney, at stations where there has been the prospect of considerable future usage.

Education and Training

The C.E.G.B. enthusiastically supports the view of the Beaver Committee that if any industry is to operate without causing undue atmospheric pollution, it is vital that the staff responsible for the operation of boiler plant should be properly trained. Since 1948 two training establishments have been maintained by the industry, and regular courses of instruction have been provided for all grades of employees. The instruction is given not only by specialists employed by the industry but also by other acknowledged experts. For example, to date 3,960 boiler operators and 1,292 shift charge engineers have passed through approved courses of training which include boiler operation.

The above courses are not in any way meant to complete the education of staff. This is continued at the place of employment, not only by the trained engineers of the power station but also by efficiency testing engineers in each Division of the Generating Board.

It is realised that the staff responsible for the operation of boiler plant may feel frustrated if they are taught detailed procedures for good operation, only to find that the plant which is in their care is without the necessary control instruments. In power stations, however, not only are the boilers fully instrumented to maintain high efficiency but, in addition, automatic controls are commonly provided to assist in obtaining good combustion and to ensure the correct sequence of operations such as soot blowing. All these measures materially assist in minimising atmospheric pollution.

Summary

In this article it has not been possible to describe in detail the many measures taken by the electricity generating industry to ensure that station boilers are, in the words of the Clean Air Act " so far as practicable capable of being operated continuously without emitting smoke." It is the belief of those in the industry that at the present time not only has full advantage been taken of the best practicable methods, but that the part played by the industry itself in obtaining and applying essential knowledge has been considerably greater than could be claimed by any other industry in the world. For each new generating station the combination of precautions required is considered on its merits to obtain on a national scale the best return from the resources used in reducing pollution. It is believed on the full evidence available that the steps taken in planning recent power stations have been fully justified. In fact, if all the fuel which is burnt in this country to-day for heating and power production were burnt as efficiently as in modern power stations, and the gases discharged as effectively, the problem of air pollution by solid particles as we know it to-day would cease to exist.

Looking to the future, those concerned with cleaner air cannot be complacent. Investigations are continuing and the Board will take full advantage of the knowledge gained. With improved design techniques there appears to be adequate scope for dealing with the emission problems from the even larger stations which will undoubtedly become necessary to meet economically the ever-increasing demand for electricity.

Rural Electrification in Europe

IN response to a request made by the Committee on Electric Power at its fourteenth session, the secretariat of the United Nations Economic Commission for Europe is to prepare and publish annual reports on " The State of Rural Electrification in Europe." The first of these, for 1956, provides a general picture of the pattern of development and the factors common to all countries, but its value is restricted by the fact that the various national statistics are rarely comparable. It is stated, however, that detailed inquiries will be made in all countries in order that future reports may be based on a more consistent body of data.

For those countries where rural electrification is well established, the most acute problem at the end of 1956 is said to have been the renewing and reinforcing of existing installations. Sweden, for example, although 98·7 per cent electrified, has to face the prospect of investing some kr.200 million (about £13 million) in existing networks if a satisfactory supply is to be maintained to all consumers. With the extension of national grids there are now only a few small power stations supplying rural networks only, but in Hungary a 20 kVA turbo-alternator set has been developed for operation on heads of 7 to 12 metres under a flow of 200 to 300 litres/sec. It is prefabricated in the factory, is said to require little engineering work to install, and is automatically controlled.

The average annual consumption per rural consumer varies widely from about 400 kWh in countries like Austria and France to 6,000 to 8,000 kWh in the United Kingdom. In most countries the total annual rate of increase has been considerably more than what would correspond to a doubling of consumption in 10 years, and the indications are that this rate of increase is far from slowing down.

Lightning Arrestors

RECOMMENDATIONS for Lightning Arrestors, Part I (Publication No. 99-1) has been issued by the International Electrotechnical Commission, 1, rue de Varembé, Geneva (8 Swiss fr. plus postage). The recommendations apply to arrestors consisting of single or multiple spark gaps in series with one or more non-linear resistors. Such resistors offer a low resistance to the flow of high discharge currents, thus limiting the voltage across the arrestor terminals, and a high resistance at normal power-frequency voltage, thus limiting the magnitude of follow current. The document includes sections on definitions, standard ratings, test specifications and the selection of voltage ratings. Two appendices give details of a typical circuit for operating duty tests and a list of abnormal service conditions that may require special consideration.

NEW BOOKS

Pulse and Time-Base Generators. By D. A. Levell. Pp. 175; figs. Sir Isaac Pitman & Sons, Ltd., Pitman House, Kingsway, London, W.C.2. Price 25s.

This book deals with the principles underlying the design of pulse and time-base generators for radar, television and electronic instrumentation. After an introductory chapter, the author discusses linear circuits, considering both passive networks and valves operating in the linear part of their characteristics. Non-linear devices, such as diodes and clipping circuits, are then described. Chapters on pulse modulators, trigger circuits and multi-vibrators and negative transconductance trigger circuits follow. The penultimate chapter deals with circuits for magnetic deflection cathode-ray tubes and the last chapter is on transistor circuits. Each chapter is followed by a good bibliography.

Since the total length of the book is under 200 pages the treatment of most circuits is somewhat cursory and few design data are given. This is particularly true of the sections dealing with precision circuits, phantastrons, sanatrons and sanaphants, where the features leading to precision are not very well brought out. However, the concise nature of the book does mean that an overall view of the subject is obtained without the expenditure of an undue amount of time and this was, presumably, the author's intention. The printing is good and the many diagrams are clear.—A.H.W.B.

High-Voltage Circuit-Breakers. By Vladislov Zajic. Translation from Czech edition by Jean R. Cavanova. Pp. 324; figs. Constable & Co., Ltd., 10, Orange Street, London, W.C.2. Price 25s.

The first of the four main sections into which this book is divided is concerned with basic principles of circuit-breaker construction and includes an historical review of circuit-breaker development. The second deals with the duty imposed upon circuit-breakers while the third concerns the construction and principles of arc interruption in high-voltage circuit-breakers and the fourth discusses methods of proving circuit-breakers for short-circuit interrupting ability. The book should be most useful to engineers concerned with the manufacture or the application of circuit-breakers to systems. The annotation is good and the work amply indexed and illustrated.

In the historical section which includes a chronological review of circuit-breaker development, it is surprising that the E.R.A. contributions to circuit-breaker construction and technique have not been mentioned. I refer in particular to the E.R.A. cross-blast arc-control device for use in oil circuit-breakers, and to air-blast circuit-breaker constructions based on the original short-arcing gap technique of the E.R.A. Arrangements embodying the latter technique are in world-wide use to-day.

Concerning system analysis the author gives a great deal of attention to the assessment of recovery voltage, of restriking voltage and of rate-of-rise of restriking voltage. No mention is made of non-sinusoidal restriking voltage waveforms. These are significant where the short-circuit level of the system is very high.

In the third section on circuit-breaker construction, many old and modern circuit-breakers are amply illustrated, but recent advances in construction, particularly in air-break circuit-breakers, have outpaced the publication. For example, in air-break designs constructions are available having ratings as high as 500 and 1,000 MVA at 11 kV. The principles of circuit breaking in air-break, air-blast and oil circuit-breakers are outlined in this section. Much of this work takes the form of an integration of published information and is a very useful collation of this material. Basic design principles are also outlined.

The last section, on short-circuit testing, would have been more complete if something had been said about making short circuits which, in some instances, is the limiting factor in the rating of a circuit-breaker.

A greater understanding of the performance limit of circuit-breakers would be conveyed to the student if writers on circuit breaking emphasised that during arcing and immediately after circuit breaking not only the arc path but all insulation in parallel with it, and especially that in the proximity of the arc control device, is subject to the voltages obtaining at these times. Nevertheless, this book is of such calibre that it fulfils a definite need.—D.F.A.

Hydro-Electric Engineering Practice. Edited by J. Guthrie Brown. Vol. 1, "Civil Engineering," pp. 1,190, figs., £9 9s; Vol. 2, "Mechanical and Electrical Engineering," pp. 770, figs., £6 6s; Vol. 3, "Economics, Operation and Maintenance," pp. 500, figs., £4 4s. Blackie & Son, Ltd., 16, William IV Street, London, W.C.2.

A sweeping survey of knowledge and practice in the broad field of engineering embraced by this work may fairly be expected to make a considerable impact on engineers. The authors and publishers have doubly reinforced their scholarship, by stressing the force of gravity—the three volumes weigh over 15 lb—and by producing a technical book whose sheer quality as a printer's work can scarcely have been surpassed since the war. If anything this is overdone: had the margins been of normal size the pages would have been better filled and an inch of width and depth would have been saved.

It is impossible not to welcome the appearance of a dependable guide to British thought and practice in hydro-electric engineering. Those whose lives are bound up in this work have hitherto relied on American handbooks for guidance and with one American volume in particular this new venture will inevitably be compared. It is unquestionably better — being bigger, covering more ground, and being more acceptable to British minds: it is, alas, much more expensive. For the individual, aspirations are likely to be limited to the volume most connected with work in hand, and on this basis one can acquire a valuable counsellor for many years to come.

The book is claimed to be suitable for advanced students, but this claim, so common among publishers of technical books, is not a fair one and except for certain chapters these books are for the practising engineer specialising in hydro-electric work. Another claim often reiterated is that not only British but also overseas and Continental practice is well covered. This is regrettably untrue. A work which truly set out British and Continental methods, comparing them and judging the best of all worlds, would indeed be a guide beyond compare. In this case a few photographs, cross-sectional views, and an occasional sentence refer to other countries, but there is never, except in a limited number of chapters by certain authors, a sustained and careful study of varied national

practice. In general, foreign practice is better documented in Vol. 1 than in Vol. 2, where very much more information on overseas practice would have been invaluable.

The first volume deals, one might almost say majestically, with the investigation of run-off, river flow, basic hydraulics, the overall design of hydro-electric developments, civil engineering design of dams, tunnels, canals, etc.; and those items of mechanical plant such as control gates and portal valves which are integral with the civil works. There is a useful chapter on fishery considerations and a controversial one on the æsthetics of water power developments more calculated to remind the engineer of his responsibilities than to help him greatly in discharging them wisely. Dr. Jaeger contributes an excellent chapter on underground power stations.

The second volume on plant is of more interest to *Electrical Review* readers. It includes the best published survey of water turbines in existence and waterwheel generators are also excellently covered. These chapters, although inhibited slightly by their individual author's personal allegiances, are among the best in any of the volumes. In common with almost all of Vol. 2 the turbine and generator chapters tell us practically nothing of Continental practice: one may instance as a major item the totally immersed " bulb " turbo-generators being installed at the Rance tidal scheme in France; and as a small point the development of annular servo-motors. Neither is referred to.

An incredible omission is that of turbine valves, a field in which the British development of the straight flow valve has been notable. The index in Vol. 2 refers us on this subject to the last index page of the previous volume, which hardly helps. In such a comprehensive production this omission is perplexing.

Chapters are included on switchgear, controls, auxiliary systems, etc., but tend to reflect particular views. It would have been useful to have more actual economic comparisons: the choice of a control system is usually dictated by manpower savings, effects of distance on cable costs, carrier terminal equipment costs, etc.

The chapter on transmission, which is really first-class, includes a detailed cost examination and is exceptional in so doing. In discussing auxiliaries it is surprising that no mention is made of transformers filled with non-inflammable synthetics, avoiding the usual siting and fire-protection problems.

There is a good chapter on pumped storage plant, but no details are included of the reversible pump-turbine with adjustable blades developed in this country and installed in the new Sir Adam Beck station in Canada.

The third volume covers the supply authority's interest in a hydro-electric scheme—the economics of operation. It could well have been dispensed with in its present form. The first fifty pages are historical and general, a good deal of the remainder duplicates or enlarges upon material in the earlier volumes and would have been better incorporated in them. Parts of the volume emulate a verbose engineering report and careful pruning would have made them more readable. It is difficult to see why chapters on: " Trends in the Development of Generating Plant," should not have been included in Vol. 2; and two appendices, on wind power and on nuclear plant, are scarcely justified: the latter in particular was bound to be out of date within months of being written (1955).

There is a great deal of valuable advice in Vol. 3, but its careful rearrangement elsewhere would have improved the layout of the work as a whole and saved considerably in cost.

The authors, who are too numerous to list here, are drawn from two well-known firms of consulting engineers, with some well-known specialists from manufacturers for the sections on plant. Criticisms such as we have set out above are inevitable in a work of such scale, especially one so completely new. The market for a book like this must be limited, but a splendid work has been produced of immense utility to those of us engaged in water power development.—H.M.

Electric Contacts. By Ragnar Holm. Pp. 522; figs. Springer-Verlag, Berlin, W.35. Price DM.52.50.

The author has rewritten and enlarged his previous book on this subject published in 1946. The present volume includes new information and many recent references. Part I is devoted to the theory of stationary contacts. The author deals in detail with various factors affecting contact resistance, including the calculation of constriction resistance, of contact area and of the temperature distribution in a contact. The theory of sliding contacts is discussed in Part II. Both the electrical and mechanical properties of brushes are considered.

In Part III, which is concerned with electrical phenomena in switching, the author includes a good introduction to circuit interruption and mentions factors affecting arc re-ignition. Considerable space is devoted to the experimental static volt-ampere characteristics of short arcs as found in electric contacts and these are used to calculate the arcing time when interrupting resistive circuits. The author introduces a series of simplified volt-ampere characteristics applicable to any contact material which will give an approximate value of the arcing time. He uses a step-by-step method of calculating the arcing time in inductive circuits and then considers quenching circuits to reduce the arc duration.

After a section devoted to the history of contact research, eleven appendices are included. Most of these give further information on physical theories which have been mentioned only briefly in the text. The appendix giving a table of physical properties of a variety of contact materials is most useful.

This book is very comprehensive at the expense of being rather involved. It is a pity that the author could not have made more distinction between the introductory material in the various sections and the very detailed theory. Unfortunately, there are a number of unusual abbreviations due to the book having been printed on the Continent. Many people will welcome the use of the M.K.S. system of units. The author, who is an expert in this field, includes an extensive bibliography and good index, which makes this a useful reference book.—I.A.B.

Technical Report Writing. By James W. Souther. Pp. 70; figs. John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 24s in the United Kingdom.

Not only does the author criticise sample reports and offer numerous suggestions to improve the style, form and content, but he has tried to give a complete account of how to write a technical report from the initial request to the final proof. The book is arranged logically and the material is well presented. Chapters are divided as follows:—Analysis, investigation, design or form, and the actual writing of the report.

Since this book is published in the U.S.A. the suggested sources of reference are mainly American. Much of the book is just common sense and the section on form is interesting, but not particularly useful, as most companies and publishers have their own ideas on layout to which the author must conform. It is, however, a useful book for the beginner in that it gives a complete treatment of the fundamentals of report writing.—T.C.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

In the list of names of electrical men who received recognition in the Birthday Honours, given in our last issue, we included **Mr. L. M. Simpson,** manager and chief engineer of the telegraph division of the Automatic Telephone & Electric Co., Ltd., who was awarded the O.B.E. We have since received a portrait of Mr. Simpson, which we now reproduce.

Mr. L. M. Simpson

Mr. A. C. Cooper, general sales manager of I.T.D., Ltd., a company closely associated with the Austin Motor Co., Ltd., Crompton Parkinson, Ltd., and Clark Equipment International C.A., was recently elected president of the British Industrial Truck Association. He has also been appointed to the British National Committee of the Federation Européenne de la Manutention, an organisation devoted to the creation and maintenance of common standards of practice in the engineering industries with particular reference to handling techniques.

Mr. B. N. Dunster, M.I.E.E., who recently left Siemens Edison Swan, Ltd., due to integration, is now representing in the London area E.M.P. Electric, Ltd., of Tottenham, N.17, surge divertor and h.v. and l.v. fuse manufacturers, and also the Termination Equipment Co., Ltd., of Nottingham, makers of terminal blocks and allied apparatus.

Mr. B. N. Dunster

Mr. Dunster was for eighteen years London sales manager to the Siemens organisation, previously being chief technical assistant with consulting engineers in Westminster. His office is at 12, Seymour Street, Portman Square, London, W.1 (telephone: Welbeck 4669).

The Central Electricity Generating Board has appointed **Mr. W. T. Bamford,** B.Sc.(Eng.), A.M.Inst.C.E., A.M.I.Mech.E., **Mr. J. Harvey,** A.M.I.Mech.E., M.Inst.F., and **Mr. W. H. Foster,** A.M.I.E.E., M.Inst.F., to be chief generation engineers (operation) of the London, the South Eastern and the Yorkshire Divisions, respectively.

After serving an apprenticeship with the British Thomson-Houston Co., Rugby, Mr. Bamford joined the London Electric Supply Corporation in 1925 as a technical assistant at the Deptford East power station. He subsequently held positions at Acton Lane, Battersea and Deptford East power stations before becoming deputy station superintendent at Acton Lane and then station superintendent at Fulham. He was appointed generation engineer (operation) in the London Division in 1950.

Mr. Harvey served his apprenticeship with W. Sisson & Co., Gloucester. After periods with W. S. Barron & Co., Gloucester, and the Peninsular & Oriental Steam Navigation Co., he became a shift charge engineer with the Gloucester Corporation Electricity Department, subsequently holding positions at Sculcoates Lane (Hull) and Fulham. He was then appointed station superintendent at Woolwich and later transferred, in the same capacity, to Barking "A" and "B" power stations. In 1952 he was promoted to generation engineer (operation) with the London Division, Group IV.

Mr. Foster was apprenticed at the Barnsley Main Colliery and became electrical engineer there. In 1943 he joined the Yorkshire Electric Power Co. as an assistant charge engineer at the Ferrybridge power station and three years later went to Fulham as charge engineer, subsequently becoming assistant operating engineer. In 1949 he became assistant station superintendent at Brighton "A" power station, was appointed superintendent a year later, and in 1952 took over the responsibilities of both Brighton "A" and "B" power stations. Mr. Foster was appointed generation engineer (operation) with the London Division in 1956.

Mr. J. L. Ritchie, B.Sc., M.I.Mech.E., has been appointed personal assistant to the managing director of the Consolidated Pneumatic Tool Co., Ltd. The appointment becomes effective as from 1st July. Mr. Ritchie is leaving the board of Aveling-Barford, Ltd., Grantham, with whom he has been associated for nearly twenty-five years.

The **North East Electrical Club** held its annual golf outing at Ravensworth Golf Club, Co. Durham, last week when over 80 members and friends attended. The Mullens Trophy and President's Tankard were won by Messrs. P. Patterson and W. Smith, respectively. The best net score by a guest was made by Mr. K. Walters with Mr. H. F. Howcroft second. The foursomes winners were Messrs. W. Dixon and R. W. Law, the second prize being secured by Messrs. T. E. Dellow and J. Davis.

Mr. R. M. I. Hobill has been appointed manager of the Transformer Department of Ferranti, Ltd., following the resignation of Mr. J. E. L. Robinson. Mr. Hobill was previously transformer sales manager.

Mr. F. C. Chown, Newcastle area superintendent of the A.E.I. Lamp & Lighting Co., Ltd., has retired. He will be succeeded by **Mr. J. E. Sutton.** Mr. Chown joined Metrovick Supplies, Ltd., in 1922, as sales engineer. In 1933 he was appointed Newcastle-upon-Tyne lamp and lighting superintendent and opened branches at Stockton and Workington. On the formation of the A.E.I. Lamp & Lighting Co., Ltd., in April, 1956, he became area superintendent.

Mr. F. C. Chown

Mr. L. C. Pocock, who has just retired from Standard Telephones & Cables, Ltd., after nearly forty-six years' service, has an international reputation as an authority in the speech transmission field, from both the system and component design angles, and was early associated with the late Sir Frank Gill in work on the international standardisation of transmission. He has made many notable

Mr. L. C. Pocock (left) receiving presentations from Mr. C. P. Smith on his retirement

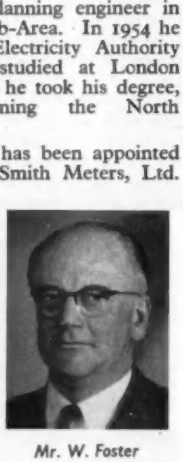
contributions to the improvement of standards of transmission for telephone transmitters and receivers. As a member of the Medical Research Council's Acoustic Committee, Mr. Pocock has done valuable work in the hearing-aid field. From the earliest days of the C.C.I.F. he has taken an active part in its work on transmission quality and testing for the regulation of international telephony. On his retirement from Standard Telephones & Cables he was presented with a book of signatures of his colleagues and a tape recorder, the presentation being made by Mr. C. P. Smith, chief telephone apparatus engineer.

Mr. A. H. Parr has been appointed secretary of the Northern Ireland Electricity Board in succession to **Mr. L. McMaster,** who has retired.

The Eastern Electricity Board has appointed **Mr. J. P. Weston,** B.Sc. (Econ.), A.C.T.(Birm.), A.M.I.E.E., as senior assistant engineer (tariffs and economics) in the Chief Commercial Officer's Department at Wherstead. Mr. Weston, who was educated at King Edward's Grammar School, Birmingham, and at the Birmingham College of Technology, started his career on the clerical staff of the Birmingham Electric Supply Department in 1939 and he saw service in the Army during the war. Later he held positions with the Midlands Electricity Board and the English Electric Co., Ltd., Stafford, and in 1951 he joined the North Western Electricity Board as an assistant planning engineer in the Lakelands Sub-Area. In 1954 he won a Central Electricity Authority scholarship and studied at London University, where he took his degree, afterwards rejoining the North Western Board.

Mr. J. P. Weston

Mr. W. Foster has been appointed to the board of Smith Meters, Ltd. He retains his directorship of J. H. Robinson & Co. (Liverpool), Ltd.



Mr. W. Foster

The North Western Branch of the **Electrical Trades' Commercial Travellers' Association** held its annual bowling match on 13th June at the Rope and Anchor Inn, Dunham Massey, Altrincham. Mr. C. G. Walker won the men's prize and Mrs. W. E. Garratt the ladies'.

The Benjamin Electric, Ltd., is setting up a new sales area which will be known as the South West Area, with offices at Royal London Buildings, Baldwin Street, Bristol (telephone: Bristol 28406). **Mr. R. H. Hill,** who for a number of years has been the company's sales engineer in Bristol and the South West of England, has been appointed manager, and the new organisation becomes operative on 1st July. The new sales area will include the geographical area covered by South Western Electricity Board, South Wales Electricity Board, Central Gloucestershire Area of the Midlands Electricity Board, and that part of the county of Wiltshire in the Newbury Sub-Area of the Southern Electricity Board. Mr. Hill is this year's chairman of the Bath and Bristol Centre of the Illuminating Engineering Society.

Mr. R. H. Hill

Mr. B. G. Ash, who has had eighteen years' experience in contracting and the electrical industry, joins Mr. Hill as sales engineer as from 1st July, having for the last few years operated from Bristol for Veritys, Ltd. **Mr. J. D. Ducker,** who has operated in the northern area for the Benjamin Electric, Ltd., transfers, with effect from 1st July, to the Midland area, and will take over the Merseyside and North Wales territories.

OBITUARY

Mr. E. A. Reynolds, M.A., M.I.E.E. —The death occurred on 17th June of Mr. Ernest Arthur Reynolds, principal of Reynolds & Bradwell, Ltd., the Birmingham electrical contractors. Mr. Reynolds was born in Birmingham, the son of a former Lord Mayor, in 1877. He went to King Edward's High School in the city and proceeded from there to Pembroke College, Cambridge, where he graduated M.A. (Mathematical Tripos, 1899, and Mechanical Science Tripos, 1900—both first class). After spending five years with Willans & Robinson, Ltd., Rugby, he helped to found the firm of Reynolds & Bradwell in 1905. He joined the Electrical Contractors' Association in 1911 and had served the Association in various capacities, having been vice-president in 1938-40 and again in 1943-45.

Mr. Reynolds joined the Institution of Electrical Engineers as an associate in 1901 and had been a member since 1912. He had served on the I.E.E. Council and had been a member of the Wiring Regulations Committee since 1930; he had the distinction of being concerned with the last four editions of the Regulations. He was a member of a number of B.S.I. and E.R.A. Committees and he was chairman of the City and Guilds of London Advisory Committee on Electrical Installation Work from 1930 until his death.

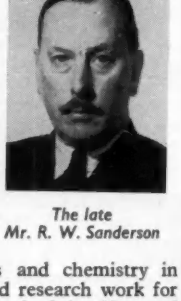
Mr. Reynolds was a regular attendant at the E.C.A. annual conferences and was present at the Folkestone conference as recently as last month.

Mr. G. M. S. Sichel.—The death occurred on 20th June, at the age of seventy-four, of Mr. Gerald McKenzie Stuart Sichel, B.Sc., M.I.E.E., formerly of the Metropolitan-Vickers Electrical Co., Ltd. Mr. Sichel served his apprenticeship with the Erection Department and was then successively assistant engineer, London Erection Department; district engineer, Glasgow; assistant superintendent, Erection Department, Trafford Park; district erection engineer; and consulting engineer for Metropolitan-Vickers in London. Mr. Sichel, who retired in 1956, had written several articles for the technical Press.

Mrs. Lucy Grindrod, chairman and co-founder of Hardman & Co., Ltd., electrical and radio wholesalers, and Philco Distributors (Lancashire), Ltd., of Rochdale, died on 21st June. Mrs. Grindrod founded the firm of Hardman & Co., Ltd., in 1920 in partnership with her husband, Mr. Frank Grindrod, who died on 2nd February this year at the age of sixty-one.

Mr. Simpson Blackett, assistant commercial engineer for the North Eastern Electricity Board's Redcar district, has died suddenly in hospital at the age of 56. He was previously an electrical engineer with Eston Urban District Council.

Mr. R. W. Sanderson.—The death occurred recently of Mr. Roger Whaley Sanderson, a senior member of the Wembley Research Laboratories of the General Electric Co., Ltd. Mr. Sanderson, who was 58, was educated at King Edward's School, Birmingham, and entered Birmingham University in 1918, gaining an honours degree in physics and chemistry in 1920. He then did research work for the Department of Scientific and Industrial Research in the University and joined the staff of the G.E.C. Research Laboratories in 1923. He was responsible for research and development work on primary batteries until 1957, when he took charge of a newly-formed group working on corrosion problems. He served on various B.S.I. Committees and was permanent chairman of the Battery Committee of the International Electrotechnical Commission.



The late Mr. R. W. Sanderson

Mr. R. W. Hughman.—We regret to record the death, on 23rd June, of Mr. Robert William Hughman, Companion I.E.E.; he was eighty-eight. Mr. Hughman was associated with Robert Hammond in the founding of *Lightning* (which subsequently became

the *Electrical Times*) in 1891. He was then secretary of the company but in 1895 became assistant editor and six years later general manager. In 1907 he was appointed joint managing director and was later sole managing director, a position from which he retired in 1947.

Robert Hughman, during his long connection with the *Electrical Times*, became a leading figure in electrical circles and his knowledge of the industry was extensive and profound. He was very popular, and not least with his friendly rivals of the other electrical journals.

WILLS

Mr. R. Lee, M.B.E., M.I.E.E., A.M.I.Mech.E., formerly sub-area liaison officer to the London Electricity Board, and previously borough electrical engineer of St. Pancras, who died on 15th March last, left £5,440 gross (£5,301 net).

Mr. J. P. A. Meldrum, director of the Metropolitan-Vickers Electrical Co., Ltd., who died on 20th January, left personal estate in England and Scotland valued at £13,512.

Mr. R. E. Livesley, B.Sc., A.M.I.E.E., formerly manager, Newark District, East Midlands Electricity Board, who died on 18th December last, intestate, left £6,833 gross (£6,624 net).

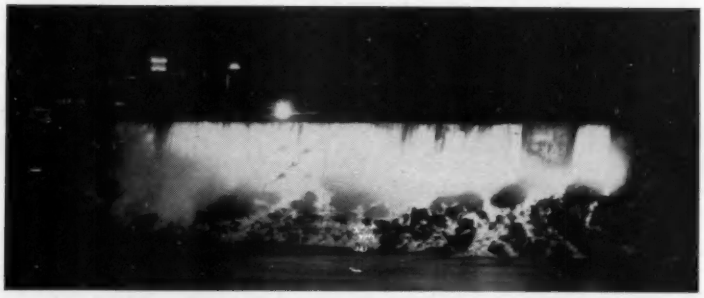
A.E.I. Product Divisions

Two Associated Electrical Industries Divisions become operative on 1st July. They are the A.E.I. Turbine-Generator Division, managed by the Metropolitan-Vickers Electrical Co., and the A.E.I. Heavy Plant Division, managed by the British Thomson-Houston Co. These Divisions will handle the design, manufacture and sales of all products falling within these categories. They are the first A.E.I. Divisions to be formed, following the chairman's announcement at the time of the annual general meeting of the proposed change to an A.E.I. divisional organisation based on products.

The headquarters of the Turbine-Generator Division is at Metropolitan-Vickers, Trafford Park, Manchester, 17, and the Heavy Plant Division at British Thomson-Houston, Rugby. The following management appointments have been made:—

A.E.I. Heavy Plant Division:—Messrs. L. Drucquer, divisional general manager; L. D. Anscombe, divisional chief engineer; C. W. Furniss, divisional manufacturing manager; R. M. Grant, divisional commercial manager; and N. R. D. Gurney, divisional executive (Manchester).

A.E.I. Turbine-Generator Division:—Mr. R. J. Cochran, divisional general manager and divisional commercial manager; Dr. W. H. Darlington, divisional chief mechanical engineer; and Messrs. W. N. Kilner, divisional chief electrical engineer; R. R. Whyte, divisional manufacturing manager (Trafford Park); D. R. S. Turner, divisional manufacturing manager (Larne); and J. G. Boddy, divisional executive (Rugby).



The American Falls and Bridal Veil at Niagara seen under the new colour floodlights installed by the General Electric Co., Ltd.

Colour Floodlighting at Niagara

A NEW British colour floodlighting installation was switched on at Niagara Falls on 20th June. The system, costing $155,000 (about £55,000), has been supplied by the General Electric Co., Ltd., through its Canadian associate company, the Amalgamated Electric Corporation, Ltd., for the Niagara Falls Illumination Board. It consists of 20 colour floodlighting projectors mounted on the Rotunda in Queen Victoria Park. The Canadian Horseshoe Falls are illuminated by ten projectors; three more light the Upper Rapids; two light the rock face at the base of Goat Island; and five "throw" their light 3,000ft to the 1,000ft wide American Falls.

This marked the successful culmination of months of research and development work which led to the awarding of the contract to the British company in the face of strong American competition. Problems were posed by the climatic conditions, ranging from below freezing to near tropical temperatures and including the hazard of wind-blown spray. The work involved the production of several models before a prototype was built and tested at Niagara in 1957.

Despite modern developments in light sources, experiments in the G.E.C. Research Laboratories, Wembley, proved that the best light source for floodlighting Niagara Falls effectively was the high current density carbon-arc. The arc operates at 150 A, 75 arc volts, giving a crater brightness of 80,000 candelas per sq cm. The optical system is provided by a paraboloidal silvered glass reflector 90 cm in diameter having a focal length of 42 cm and the resultant beam candlepower is 210 million candelas.

The 20 specially designed weather-proof high current density carbon arc projectors incorporate remotely-controlled automatic colour-changing devices, and wide beam arrangements will be used to provide a large range of dramatic lighting effects. The projectors were supplied under sub-contract by Savage & Parsons, Ltd., Watford.

Attached to the front of each projector is an anodised sheet aluminium housing, 8ft high by 4ft wide by 2ft deep. Framed in the front and rear faces are two 36in diameter, $\frac{3}{8}$in thick, toughened glasses which allow the floodlight beam to pass straight through the unit. The unit contains five vertical channels on each side which allow five colour frames, each 37in square, to pass up and down. Each frame houses a sheet of "Cinemoid." Each colour frame is operated by an individual RQR motor of the capacitor induction type, the coils being former wound and impregnated to withstand humid conditions.

The control panel carries 20 vertical banks of switches with an indicator showing the colour controlled by each row. Used singly, or in combinations of two or three, the five specially chosen filters in each colour control unit permit 15 hues to be projected either in vertical or horizontal bands.

Forced ventilation from a high speed motor-driven blower is provided for each unit to prevent rapid fading of the colours owing to heat generated by the arc.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £194 10s 0d
Fire Refined 99·70%	ton £193 0s 0d
Fire Refined 99·50%	ton £192 0s 0d
COPPER Tubes ..	lb 1s 11½d
Sheet	ton £222 10s 0d
H.C. wire and strip ..	ton £248 5s 0d
LEAD, English ..	ton £74 5s 0d
Foreign	ton £73 0s 0d
MERCURY	flask £76 0s 0d
TIN, block (English) ..	ton £730 5s 0d
ZINC, G.O.B. Foreign	ton £64 15s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 6½d
Sheet	ton —
Wire	lb 2s 4½d
PHOSPHOR BRONZE Wire	lb 3s 8½d
PLATINUM	oz £25 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 22½d—22¾d

Ice Cream Manufacture

THE manufacture of ice cream in the new Lyons Maid factory of J. Lyons & Co., Ltd., at Bridge Park, Greenford, Middlesex, is controlled and checked by electronic devices at every stage from raw materials to final product. The system of cleaning and sterilising complicated plant and vats is also automatically controlled. All manufacturing processes take place on the first floor while the ground floor is given over to engine rooms, coal stores, storage tanks for the raw ingredients and the laboratory. The upper floor is completely waterproof and all pipelines for ingredients, water, electricity and other services are led up through the floor. The production area is thus free of pipes coming down from above. Lighting, heating and ventilation are all kept flush with the ceiling and the ventilation is adjusted so that air pressure inside the building is always slightly above atmospheric.

When the raw ingredients arrive at the factory in a liquid state, the tanker is connected to a pipeline which is then switched, at the central control panel, to the appropriate storage vat. Each vat is mounted on load cells which have been developed from strain gauges used in aircraft stress tests. As the liquid enters the storage tank the increased weight is measured electrically and indicated on the control panel. These weights can also be recorded automatically on an electric typewriter.

The raw ingredients are directed to the mixing plant from the storage vats by the panel operator. Electric circuits trigger the compressed air valves of the various pipelines, and when the circuit has been arranged the pumps come into action and transfer the ingredients to the mixing section. The proportion of ingredients required is set up on the control panel and the first ingredient pours into the weighing pan. As soon as the predetermined quantity of material has entered the pan, the valve closes and the next ingredient pours to the weigher. When all the materials have entered the pan the valve opens and they pour into one of the steam-heated vats. Here the ingredients are heated and blended into a uniform mixture by high-speed agitators.

Another method of mixing which is also being used and developed in the factory is by the use of a proportioning pump in place of the weighing pan.

After being homogenised, the mix passes through a pasteuriser into stainless steel storage vats where it is held until required for freezing. The freezer consists of a central chamber or tube equipped with rotating steel blades and an insulated jacket within which liquid ammonia is circulated at very low temperature. The mix is pumped into the chamber and the rotating blades scrape the freezing mix from the walls of the tube. The frozen ice cream is extruded in a continuous ribbon and cut into the required lengths.

The incoming supply is at 6·6 kV which at present feeds five 1,000 kVA, 11,000/415 V transformers of Watford manufacture. The 415 V air-break switchgear is by Whipp & Bourne with distribution boards and fusegear by Lancashire Dynamo & Crypto, Ltd., and English Electric. The control circuits operate at 50 V and the wiring is in m.i.c.c. by Pyrotenax, Ltd.

The automatic weighing for the continuous mixing plant was supplied by W. & T. Avery, Ltd., heating and cooling in the factory by United Air Coil, Ltd., and refrigeration plant by York Shipley, Ltd. The manufacture of many of the control panels and mimic diagrams was carried out by F. H. Pride, Ltd. Electronic counting and recording equipment is by Londex, Ltd., and the central control panel was made by Elliot Bros. (London), Ltd. Refrigerator motors are by Crompton Parkinson, Ltd., the main cabling was manufactured by Scottish Cables, Ltd., and the wiring contractors were Lock & Sores, Ltd. The lighting fittings were supplied by Holophane, Ltd., and electric motor control by Allen West & Co., Ltd.

Part of the central control panel

"Boiling Water" Reactor

AS a result of studies undertaken within the O.E.E.C. European Nuclear Energy Agency in the field of experimental reactors, representatives of a number of European countries and Euratom concluded an agreement for the joint operation of Norway's 10 MW Halden experimental "boiling water" reactor at a meeting in Oslo on 12th June. Representatives from Austria, the Danish Atomic Energy Commission, the Euratom Commission (on behalf of the six member countries of the European Atomic Energy Community), A.B. Atomenergi of Sweden, Switzerland and the United Kingdom Atomic Energy Authority agreed to join with the Norwegian Institute for Atomenergi—the builders and owners of the reactor—in carrying out a joint programme of research and experiments over a three-year period beginning on 1st July. This agreement is subject to funds being made available by the appropriate authorities.

The reactor, situated 120 km south of Oslo, is the only boiling water reactor in Europe and the first heavy-water boiling reactor in the world. A budget of the order of $4 million is envisaged for the joint programme, designed to study the scientific and technical problems related to this reactor type. An International Committee will approve the joint programme.

Plutonium from Nuclear Power Stations

Comments on the Recent Government Announcement

FROM A CORRESPONDENT

THE Ministry of Defence announced last week that Britain's civil nuclear power programme is to be amended so that it can produce plutonium for military purposes. This proposal had been kept a closely guarded secret and the announcement came as a complete surprise to most of the electrical industry.

The first reaction was one of surprise that the Government should find it necessary to increase the supply of military plutonium to such a large extent. Until 1956, the Windscale reactors were virtually the only sources of plutonium in this country. Since then Calder Hall "A" and "B" have come into production; Chapelcross is expected to be commissioned this year. Thus, even if the Windscale reactors are not used again, the country will shortly have eight large military plutonium producers running as compared with the two at Windscale only two years ago. To increase our plutonium producing sources still further for military purposes is a depressing thought.

It is understood that Hunterston and Hinkley Point, in addition to the next two, and larger, stations, will be operated so as to produce military plutonium. The total heat output of these stations is of the order of 7,000 MW, whilst the total heat output of Calder Hall and Chapelcross is about 1,500 MW. Thus, if the proposed programme is carried out for the four civil stations mentioned, the country's output of military plutonium should be about six times as great as that from United Kingdom Atomic Energy Authority plants only.

Technical Aspect

Until now, Great Britain has been the only country with a substantial nuclear power programme devoted exclusively to civil use and it is, perhaps, unfortunate that these civil stations now have to assume a dual role. From a technical aspect, however, if military plutonium is required then clearly the most economical way to achieve this is through the medium of power producing reactors, and it would appear that such stations (in view of their size and number) should continue to be optimised for power production rather than plutonium only. One thing is quite certain. There should be no argument whether these particular stations will be economical or not. Quite obviously they will be, since the taxpayer will have to foot the bill for any differences in cost between economic power and the cost of power from these stations.

The civil nuclear stations which will be coming into production from 1960 onwards will produce plutonium as a by-product, but this plutonium is unsuitable for military purposes if the stations are designed and operated primarily for power production. Most readers will be familiar with the processes whereby plutonium is produced in a nuclear reactor, these processes being as follows:—

$$_{92}U238 + n \rightarrow {}_{92}U239 - \beta \rightarrow {}_{93}Np239 - \beta \rightarrow {}_{94}Pu239$$

Thus, plutonium is produced from the U238 (99·3 per cent) part of the fuel, the U235 (0·7 per cent) providing the chain reaction. If the Pu239 so formed is left in the reactor it captures a neutron to form Pu240. This process continues and higher isotopes of plutonium are produced such as Pu241, Pu242, etc. Pu240, in particular, is relatively non-fissile and is a heavy absorber of neutrons. Whilst this would not appear to be important if the plutonium is to be used in a controlled-fission reactor, it seems that more than a small percentage of this isotope renders it unsuitable for military purposes.

In reactors producing military plutonium, therefore, the irradiated fuel must be withdrawn before the Pu240 has built up to any significant amount. This, then, is the basic difference between military plutonium and that produced as a by-product in civil reactors. In the first case, a short irradiation is essential (the order of this irradiation in terms of megawatt-days/tonne does not appear to have been published), whilst in the case of the civil reactors, long irradiations are essential in order to reduce the fuel cost to an economic figure.

Fuel Changing Methods

Calder Hall was designed so that the plant is shut down and the reactors depressurised in order to change the fuel, this being known as a bulk discharge system. Mainly in order to achieve a high load factor the civil stations have been designed with on-load fuel changing equipment, the intention being to change a few channels of fuel per day. This would appear to be the biggest single change required in a design in order that military plutonium may be produced. It would seem desirable to continue the principle of on-load fuel changing, but the number of channels per day to be changed will presumably be several times that envisaged in the existing designs. Extra charge and discharge equipment will be necessary and it begins to look as if life on the "pile cap" will be very active indeed!

Clearly, increased irradiated fuel pond capacity will also be necessary and it looks as if we shall have to get used to seeing very many more heavy lorries transporting irradiated fuel from these stations. On the other hand, the technical operation of these stations may well be eased in other ways since the difficulties that may be expected to arise with long irradiations will not exist. It is interesting to note that Hunterston is one of the "selected" stations, and it can only be assumed that this is because the charge and discharge equipment is very generously designed for its original purpose so that it can be easily redesigned and modified to suit the new requirements.

Position of A.E.A. Industrial Group

Perhaps the biggest question to be answered now is that of the role of the Industrial Group of the United Kingdom Atomic Energy Authority. Its present sphere of activity appears to be to produce plutonium and/or other materials for nuclear military purposes, to design and build prototype reactors for industry and to act as consultants to the electricity authorities and others in the design and construction of nuclear reactors. The Ministry of Defence statement suggests that quite a large proportion of the work of producing military plutonium will, in the future, be undertaken by the electricity authorities,

although the processing of irradiated fuel will remain in the hands of the Atomic Energy Authority. Again, although the Authority at the present time has a monopoly in the purification of uranium and fabrication of fuel elements for all types of nuclear reactors in this country, there seems to be no good reason why this work should not be undertaken by the large metallurgical firms. It is clear that the majority of the prototype work carried out by the Authority is basically for the electricity supply industry and it has become increasingly obvious that that industry is now in a position to stand on its own feet in the design of civil reactors.

As there will no longer be any distinction between the electricity authorities and the United Kingdom Atomic Energy Authority as regards the civil and military uses, the need for the Industrial Group as a separate organisation appears to be considerably weakened. After all, Harwell is responsible for basic research and could well be used for producing designs for prototypes in, say, the aircraft and shipping fields, leaving plutonium production and the construction of electric power producing prototypes to the electricity authorities and the large manufacturers. This, in itself, would also help the dilemma of the large consortia, who have invested tremendous sums of money in their development and design departments and who now see, largely through their own efforts, fewer orders coming along as a result of the greatly increased size of individual reactors. It is suggested that the time has come for a re-appraisal of the position of the Industrial Group of the A.E.A.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

N.A.L.G.O. and "Integration"

MAY I correct a small but important error in the otherwise excellent report of our Annual Conference which appeared in your journal last week.

The notice of motion calling for a Royal Commission to examine the whole field of power developments and to produce a plan for the most efficient integration of all fuel services was not as your report suggests "carried without dissent." Conference merely, on the advice of the National Executive Council, referred the motion to the Council for examination and report, and there is as yet, therefore, no question of the motion having been either supported or opposed.

London, N.W.1. W. C. ANDERSON,
General Secretary,
National and Local Government
Officers' Association.

Supplies in Rural Wales

I WAS very interested in the item in "Views on the News" in your issue of 16th May wherein you quoted the remarks of the South Wales Electricity Consultative Council chairman as previously reported in the *South Wales Evening Post*. Reference was made to farmers in East and Central Wales being reluctant to guarantee using £20 of electricity a year in return for free connection.

The point I would make is that these remarks could give the impression that the appropriate supply authority is willing to contract *individually* with intending consumers when the attitude of the South Wales Electricity Board towards a particular district appears to be, "We connect all or none."

I am not a farmer, but live in the midst of a farming community. If the Board would give me a date for connection, I would gladly guarantee £20 a year backed up with the cash if required. What happens is that the Board calls meetings of local residents, and explains details and costs of the scheme. The meeting is then called upon to elect a committee from their number, charged with the unenviable task of apportioning the cost among their neighbours and themselves. This inevitably leads to friction and delay. A row of council dwellings completed and wired some three years ago is still unconnected. I would submit that if the Board would take electricity to those who ask for it, neighbours would quickly follow suit once they realised its enormous advantages and the Board would have no difficulty in "making it pay."

"COUNTRYMAN."

Fire Research Report

THE annual report of the Fire Research Board and the Director of Fire Research for the year 1956 are included in the booklet "Fire Research 1957" issued by the Department of Scientific and Industrial Research (H.M. Stationery Office, price 5s).

With regard to pulverised fuel firing of steam boilers, the report states that apart from measures designed to exclude sources of ignition from the p.f. mill, precautions that may be taken include the strengthening of plant and the provision of explosive relief vents. An investigation into the venting necessary to prevent dangerous pressures being developed is now in progress.

Layers of combustible dust on solid surfaces may become ignited if the temperature of the surface is raised sufficiently. The effect has been studied by the Safety in Mines Research Establishment in relation to ignition of coal dust, but it obviously has a bearing on the initiation of fires in all industries in which combustible dusts occur. This has recently become of interest to the electrical industry in view of the possibility of increasing the permissible running temperatures of electrical plant following the development of electrical insulating materials capable of withstanding higher temperatures than hitherto.

A research programme of flameproof and intrinsically safe equipment undertaken by the British Electrical and Allied Industries Research Association was considered by the Committee on Industrial Fires and Explosions.

The appendices in the booklet include tables detailing the supposed causes of fires. These indicate that there has been little change in the number of fires caused by electric apparatus during 1956.

Water-Cooled Alternators

In the summary of the C.I.G.R.E. paper by Mr. W. N. Kilner (Metropolitan-Vickers) in our issue of 13th June, page 1128, it was stated that copper loss due to reduction of conductor area might reduce efficiency by 2 per cent; this figure should have been 0·2 per cent.

The Brighton Convention

DISCUSSIONS ON FIVE PAPERS

IN our last issue we published abstracts of the five papers presented at the tenth British Electrical Power Convention, held at Brighton last week under the presidency of Sir George Nelson, Bt. We now give reports of the discussions as well as an account of the speeches at the Convention dinner and the questions and answers at the Forum. The annual meeting was held on Friday last when Mr. C. R. King was invested as President for 1958-59 and it was confirmed that next year's Convention would be held at Torquay during the week commencing 1st June.

Nuclear Energy in Great Britain

Opening the discussion on Sir Christopher Hinton's paper on "The Development of Nuclear Energy for Electricity Supply in Great Britain," Mr. H. West (A.E.I.-John Thompson) agreed with Sir Christopher that a reappraisal of the situation was called for, and said that this could have most beneficial effects on future planning. Sir Christopher had mentioned a number of factors which affected the economic use of nuclear power as it was being developed to-day, and these constituted a challenge to the British nuclear industry. Collaboration within the industry took the form of co-operative effort with the Atomic Energy Authority in fuel element metallurgy, nuclear reactor physics and the safe working of reactors. Each member of the consortia spent over £1 million a year on research. The industry, however, still remained highly competitive, in that individual fuel element designs remained the property of each company, so that their products reflected those detail, but essential, differences which had been the backbone of British industrial progress. If the British nuclear industry were assured of a reasonable home programme which would not be subjected to disturbing and violent fluctuations, answers would be found to the problems which Sir Christopher had pointed out.

Mr. J. S. Pickles (South of Scotland Electricity Board) mentioned that at Hunterston they would be spending £50 million before a single unit was generated. By 1962 Scotland should be generating 20 per cent of its electricity by nuclear power, as compared with 5 per cent in England and Wales. Scotland had therefore a great deal at stake, and at first he had found the paper a little disconcerting, but he realised that Sir Christopher was only inviting them, having sketched the broad outline of their programme, to have another look at it before filling in the details.

There were two ways in which the necessary improvement in load factor could be obtained: by offering appropriate off-peak tariffs, which Mr. Pickles's Board had done with considerable success—they were now adding to their off-peak load at the rate of 40 MW/year—and by associating a pumped storage scheme with the nuclear scheme. Such a scheme was being constructed at Loch Awe to come into operation in 1964-65 and to develop 400 MW.

Mr. H. M. Mathews (B.E.A.M.A.) said that those concerned with putting into operation the four new nuclear power stations were passing through a period of careful reassessment to ensure that full account was taken of certain items of very recent knowledge in order to secure the smooth and economic operation of these stations, which involved substantial extrapolations from Calder Hall. There was a tendency for them to be so carried away by the enthusiasm of their design and development departments that they were in danger of regarding what had not yet been built as already obsolete. They had no reason to be discouraged, but they realised that only the most thorough design work and the best analytical studies were good enough and that it was important to integrate the design efforts of all those concerned with the power station, right down to the outgoing 275 kV feeders.

Mr. A. L. G. Lindley (G.E.C.) emphasised that it was essential to seek solutions quickly to the many problems mentioned in the paper, because it would be unwise for too long a period to regard what was being done as prototype development. The interest of many foreign countries had been aroused and a number of stations were likely to be ordered in the next two years. The aim in the next stage of development must be to reach higher fuel element temperatures, but this would have serious repercussions on mechanical design. The industry was devoting a substantial part of its research and design facilities to a wide variety of work complementary to the general programme. He felt that their attitude to the future could be one of conservative optimism.

Mr. C. L. C. Allan (North of Scotland Hydro-Electric Board) suggested that serious attention should be given to pumped storage schemes in partnership with nuclear generation. In Scotland they believed it would be

The title photograph shows the President, Sir George Nelson, with members of the Convention Council on the platform at last Friday's annual general meeting

possible to develop large pumped storage schemes at £30 to £35 per kW installed, which was far below the cost of any other method of generation. For the 400 MW scheme at Loch Awe the cost of transmission to Glasgow (50 miles) at 275 kV would be about £7/kW, and to Northern England it should not exceed £18/kW.

Mr. J. Henderson (South of Scotland Electricity Board) also emphasised the importance of pumped storage, and in particular its flexibility. He suggested that the North of Scotland Board could develop more than 2,000 MW for transmission south, and that this could be done by double circuit with four wires at ±400 kV or at 800 kV across outers. Transmission costs would be about £16/kW.

Mr. B. L. Goodlet recalled that in calculations which he had made in 1952 he had given to plutonium the value appropriate to a fuel which one did not know how to burn, namely nil. Later, it had been given an artificial value, presumably to impress the Treasury. Sir Christopher gave it a value appropriate to a fuel which one did know how to burn, but went on to say that it would burn well only in reactors of a kind not yet designed.

1. Sir Christopher Hinton presenting his paper. Speakers in the discussion: 2. Mr. H. West. 3. Mr. J. S. Pickles. 4. Mr. H. M. Mathews. 5. Mr. A. L. G. Lindley. 6. Mr. C. L. C. Allan. 7. Mr. J. Henderson. 8. Mr. B. L. Goodlet. 9. Mr. G. F. Kennedy. 10. Sir John Hacking proposing the vote of thanks

Mr. Goodlet felt that his original estimate had been about right.

Mr. G. F. Kennedy (Kennedy & Donkin) said that Sir Christopher had mentioned the possibility of going back to the use of conventional power plants. A reversion to coal-fired plants must be ruled out on a long-term basis for lack of coal, and would be extremely disturbing if applied as a temporary measure. It would be better to admit that the accelerated nuclear power programme had been a little ambitious and to aim at 6,000 MW by, say, 1970.

Sir John Hacking thought that an obvious deduction from the paper was that the risks to which the author referred should be reduced. This could be done by reducing the nuclear power programme. Imported coal, though expensive, might not be more expensive than nuclear power in the early stages. Estimates by the National Coal Board showed that coal should be available to replace a substantial part of the nuclear programme, which could be reduced to 3,000 MW by 1965.

Sir Christopher Hinton, in the course of his reply, said he had no doubts whatever about the rightness of the basic system evolved for the first-stage nuclear reactors; the gas-cooled reactor offered the greatest possibilities of development.

Overseas Nuclear Development

Sir Claude Gibb, in presenting his paper "The Development of Nuclear Energy for Electricity Supply Overseas," said that there was one major difference in approach between American and British designers. In this country it was considered essential to be able to change the fuel elements whilst on load. The application of the on-load charge/discharge principle to any other than a gas-cooled reactor, however, introduced formidable engineering problems, an acceptable solution of which had yet to be found.

Dr. K. J. Wootton (G.E.C. – Simon-Carves) said that national prestige played a part in the decision to install nuclear plant for electricity generation and it required the plant to be operated by local staff and to use where possible local materials. This gave the gas-cooled graphite-moderated reactor an advantage, in that it used natural uranium, but it would be necessary to encourage the development of fuel element manufacture and plant technology in the countries to which it was hoped to sell nuclear plant. Such plant must be capable of operating at lower load factors than in this country; a plant which could be operated economically at a load factor of 50 per cent or less would enable a unit of 100 MW or more to be considered.

Mr. J. B. Peattie (C.E.G.B.) pointed out that one advantage which this country possessed was that the programme of development and individual decisions on the position, size and nature of new generating stations were the responsibility of one body only in each of the three Board areas.

Mr. F. M. Greenlees (U.K.A.E.A.) said that Britain was fortunate in having chosen a type of reactor which had many advantages from the point of view of overseas countries. It could be built by quite a modest extension of conventional engineering techniques and had good possibilities of future development, especially with regard to the reduction of capital cost. It used natural uranium, which most countries could obtain, so that they were not tied to the country which supplied the reactor. The reactor and its fuel were offered against the background of a large domestic programme in advance of the export programme.

He believed that the fast reactor would eventually find

1. *Sir Claude Gibb.* 2. *Dr. K. J. Wootton.* 3. *Mr. J. D. Peattie.* 4. *Mr. F. H. Greenlees.* 5. *Mr. G. F. Kennedy.* 6. *Mr. E. B. Banks.* 7. *Mr. S. A. Ghalib*

a place in the power programme and that the problems of using plutonium would be overcome, so that the price of plutonium would remain relatively stable. The repurchase price offered by the A.E.A. was based only on these considerations and was not linked with military use.

Mr. G. F. Kennedy (A.C.E.) expected international competition to result in a nuclear power station with an output of 600 MW or more being provided within the next few years at a cost of less than £100 per kW installed. The financial position of some overseas countries, however, might make it necessary for them to use a reactor which could be supplied at a lower capital cost, which would mean the provision at a reasonable price of slightly enriched fuel. This country should therefore consider establishing diffusion plants close to overseas hydro-electric projects, which would produce power at a fraction of the cost at which it was available in this country. Many projects overseas were only waiting for a load such as a diffusion plant could give to justify their development.

Mr. E. B. Banks said that the cost per kWh would be very much affected by interest and amortisation rates, which varied widely from one country to another, leading to correspondingly wide variations in the cost of generation, which was likely to be a decisive factor. It was a mistake to assume that a great new field of export business had been opened up to this country in nuclear plant. No doubt valuable export business would result, but for some time to come the contracts were likely to be few and far between, and by the time they became more numerous this country would be faced by intensified international competition.

Mr. S. A. Ghalib said that of the two types of reactor using natural uranium the graphite-moderated one had a cost advantage in large sizes and the heavy-water-moderated type in medium and small sizes. In many countries low capital cost would be essential even at the expense of a marginal increase in the cost of energy sent out. With gas-cooled reactors the obvious way to reduce capital cost was to use higher temperatures, but Sir Christopher Hinton had said that it would then be essential to use enriched fuel. With heavy-water-moderated reactors, however, it should still be possible to use natural uranium. A reactor with gas cooling and heavy water moderation should hold great promise. For the less industrialised countries a variation of the pressurised water reactor, the boiling water reactor, might be considered. In this, steam was used directly in the turbine. The steam was, of course, slightly radioactive, but if it could be demonstrated that, even after the serious failure of a tube element, the turbine could be satisfactorily cleaned and decontaminated, it might be difficult on capital cost to compete with that type of reactor in some overseas markets.

Sir Claude Gibb, in reply, said it was nonsense to suggest that low capital cost went automatically with enriched fuel. If the United States continued its present policy of charging, apparently, none of the capital cost against fuel charges for overseas reactors the U.S.S.R. would be forced to follow suit, and, unless Britain pursued the same policy, this country would be completely uncompetitive in the cost of supply of nuclear fuel.

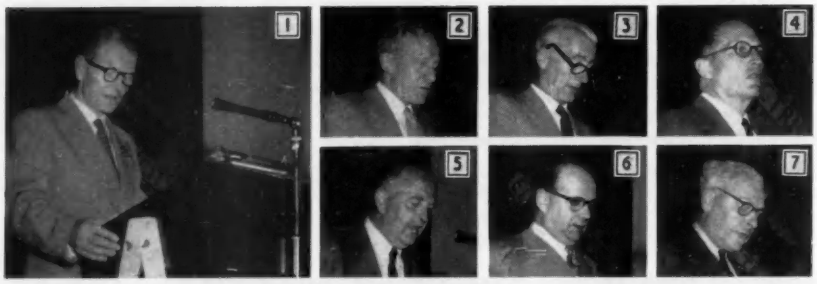
Electrical Export Business

Speaking on Mr. H. J. Beard's paper, "Britain's Part in Electrical Development Overseas," Mr. E. R. Wilkinson (E.D.A.) suggested that the crux of the paper was Table 3, which showed that the British proportion of world electrical exports had fallen steadily over the past five years, and to a greater extent relatively than that of other countries, while that of Western Germany had increased very fast. That was a challenge to the British electrical industry. Competition from Russia was likely to increase in future, having regard to the financial facilities which the Russians were offering. In this country more assistance should be obtained from the financial world. For the Kariba scheme Britain contributed 34·75 per cent of the finance, but the estimated expenditure in Britain was 25·4 per cent. Finance provided by this country should be used to a greater extent for purchases in this country. When loans were made by the Export-Import Bank of the U.S.A. the condition was imposed that almost the whole of the money must be spent in the United States. A similar body in this country, imposing the same requirement, would greatly help British participation in overseas electrical development.

Mr. J. W. H. Dore (C.E.G.B.) emphasised the importance of offering something which was demonstrably profitable in the straightforward commercial sense. To have the highest steam conditions or the largest unit rating in the world made interesting reading in the technical Press and might have a transitory sales value, but history showed that it was not the first achievement of something special which made the profit, but the first sound commercial application of new ideas. That this mundane approach had resulted in the development of the largest generating unit in the world was a reminder that striving after effect was not necessarily the best way of achieving it.

Mr. Bryan Donkin (A.C.E.) stressed the value of applied research and drew attention to the valuable work done by the various departments of the D.S.I.R., for example, in carrying out model tests on water turbine intake gates, which had been of the greatest help overseas, and mentioned also the excellent work of the E.R.A. and of the research laboratories of the engineering faculties of universities. There was a tendency in the under-developed countries to attach primary importance to education to degree standard and to overlook the need for large numbers of technicians, craftsmen and artisans. Young men in these countries had to be persuaded that the life of the skilled craftsman or technician could be just as rewarding, in the wider sense, as that of the engineer.

Mr. D. Maxwell Buist (B.E.A.M.A.) said that to maintain this country's position as the second largest supplier of the world's electrical requirements meant that United



1. Mr. H. J. Beard. 2. Mr. E. R. Wilkinson. 3. Mr. B. Donkin. 4. Mr. C. H. Flurscheim. 5. Mr. J. W. H. Dore. 6. Mr. D. M. Buist. 7. Mr. J. F. Shaw

Kingdom manufacturers had to quote for every job, large or small, in Commonwealth countries in particular, while their competitors went for the larger and more spectacular jobs and those which would lead to repeat orders. The British policy meant tens of thousands of tenders every year for amounts varying from hundreds to millions of pounds. An unduly large proportion of electrical manufacturers did not export at all. If the European Free Trade Area materialised these firms would be the most vulnerable and would be forced to export in order to exist. Co-operation was essential in any industry of which exports were a vital part, and cut-throat competition at home would lead to the disappearance of our export trade.

Mr. C. H. Flurscheim referred to the export of manufacturing plant and "know-how," and instanced a factory which was being built in India for the manufacture of electrical plant and equipment of British design. The complete factory, which would employ 10,000 people, was now being built and a school for training manual workers was being run by British engineers. Indian engineers were being trained in England. He did not agree that this form of exportation was industrial suicide. It brought prestige to this country and would lead to the export of components for many years. It would foster the goodwill of the engineers of the country concerned and help to divert to Britain orders for the more complicated machinery which such countries could not hope to make for very many years.

Mr. E. B. Banks said that while it was disappointing that the United Kingdom share of electrical exports had declined since 1952, while that of Western Germany had increased very rapidly, it should be borne in mind that in 1952 Western Germany was only just beginning to attack the export market. Comparing 1935 with 1957, the United States' share of world electrical exports had risen from 23 to 29·6 per cent, but he believed that the 1957 figure included unrequited exports such as Marshall Aid. The share of the United Kingdom had risen from 19 to 23·2 per cent, while Western Germany, at 21·2 per cent in 1957, was well below the 1935 figure of 26 per cent.

Mr. J. F. St.G. Shaw said that under the colonial regime the newly-independent countries had been virtually a closed market for Britain. Their requirements were growing, but greater competition had now to be faced. There was a tendency for them to show their independence by seeking new sources of supply, especially in view of the extravagant offers of services and credit by foreign representatives. As a rule, one found in them a small number of electricity undertakings covering the principal centres of population and supplying mainly a domestic load. To meet their needs the plant supplied must above all be simple and reliable, and where no industries were involved a different view must be taken of standards of continuity and standby equipment. In all these territories, however, loads were growing fast. Nigeria would commission its first 30 MW set next year and Malaya 100 MW of hydro-electric plant. To retain these markets it was necessary to gain and keep the confidence of these countries and develop their capacity to operate their plant. The provision by British manufacturers of service personnel in territories where their plant operated would be a major factor in promoting education and inspiring confidence.

The author briefly replied.

British Hydro Plant

Mr. A. A. Fulton (North of Scotland Hydro-Electric Board), opening the discussion on the paper by Messrs. Beverley, Teasdale and Wilmot on "British Hydro-Electric Plant and World Power Requirements," said that to maintain their position in world markets it was not sufficient for manufacturers to rely solely on laboratory tests; customers needed to know about actual performance. In this respect British manufacturers were now as well off as those of any other nation with its own domestic market, because his Board had provided a testing ground. They had willingly accepted one of the first, if not the first, straight-flow inlet valves produced, and their stations at Sloy and Clachan had been testing grounds for high-head Francis turbines, new types of thrust bearing and new voltage regulators. Tubular turbines would soon be tried out.

As new ideas in governing had been developed they had been tested in Scotland. In most cases where a large interconnected system was involved, speed governing could be an embarrassment, and often the main requirement was to produce a steady output over a period of time to follow a planned scheme of operation. For the same reason there was much to be said for the greater use of induction generators which, without any form of governor, maintained whatever output corresponded to a predetermined water opening. In both cases the only security required was to have overspeed protection in case the connections to the main system were interrupted. The Hydro Board had had satisfactory experience of induction machines up to 5,000 kW, and possibly a market for even larger sizes would develop. The Board's experience supported what was said in the paper about the development of higher speed automatic voltage regulators and their use in assisting generator stability under fault conditions on a system with long lines and when operating at leading power factors.

Mr. D. Clark (C.E.G.B.) considered that there was not much future for straight hydro-electric generation in England and Wales, but there was scope for pumped storage schemes. Cheap nuclear energy for night pumping, however, was not likely to be available before 1970, and if pumped storage was installed instead of modern coal-fired plant it meant sacrificing the considerable fuel saving possible with such plant. The most obvious cost factor in assessing the economics of pumped storage was the capital cost of the pumped storage installation compared with that of alternative coal-fired plant. Coal-fired

plant of the highest thermal efficiency could now be obtained for £45/kW. In general, it was necessary with pumped storage plant in England and Wales to look for capital costs well under £40/kW, including transmission.

Mr. G. F. Kennedy (A.C.E.) referred to the fact that the tubular design of turbine was to be adopted for the Rance tidal power scheme in France, but said he was not convinced that, if the C.E.G.B. decided to proceed with the Severn Barrage tidal scheme, the tubular turbine would be the most economic choice. There was need for investigation of gate design and application as a hydraulic and mechanical problem rather than one of structural engineering. Continental firms had taken too many orders for this type of equipment which might have come to this country if Britain had had the resources and technique. Aswan and Caroni were notable examples of such schemes. Rubber technologists must take an interest in the sealing requirements—dimensional accuracy, strength and abrasion characteristics, rubber constitution and reinforcement. Problems were arising in these fields with new pumped storage schemes where cylinder gates might be required. Urgent development work was required; we must not be in the position of having to go to the Continent for such equipment.

Mr. P. L. Blackstone said that transport of the components of the very large capacity generators now under construction had been made possible by the reduction in size and weight resulting from the development of hydrogen cooling and water-cooled conductors. This transport problem had had to be faced with hydro works for a very long time. A large hydro-generator had always to be largely dismantled before it could be sent to the site. There was a sort of inevitability about this which had made the adaptation of hydrogen cooling to hydro-generators not as yet worth while. With the present tendency to push machine sizes to even higher levels there would have to be further recourse to the North American practice of omitting works assembly and building up generators entirely at site; the site would have to become the assembly shop, and these large power stations would have to be designed with that in view.

Mr. J. A. Higgs (Boving & Co.) remarked that in spite of the substantial development of water power in Scotland and Wales since the war, the orders for turbines received by his company since 1945 had been, in terms of horse-power, 87½ per cent for export and only 12½ per cent for the home market. Typical figures for a West European firm were 32 per cent for export and 68 per cent for the home market. The paper should dispel the widely-held belief that designs in the water turbine industry had reached a stage at which further improvement could be of only marginal significance; it showed that fundamental developments were continually taking place. In addition, steady progress was being made in the general design of components and auxiliaries.

Mr. L. D. Anscombe (B.T.H.) said it was probably true at the moment that most medium and large water-wheel alternators had rotors of the laminated chain-rim type, because most existing large-output machines operated at low enough speed for this construction to be permissible from the mechanical stress aspect; but with the increasing turbine speeds now proposed more alternators would have to be built with rotors of solid plate construction, and to obtain and transport the large diameter plates required was a formidable problem. A step in output was associated with the change from the chain-rim to the solid-disc type, and for speeds in excess of about 400 r.p.m. the maximum output of a given unit could be increased by over 50 per cent.

Mr. A. Feiner (Harland Engineering Co.) pointed out that for hydro-electric plant physical size for a given output depended on the available water pressure. The 30,000 h.p. high-head Francis turbine at St. Fillans was physically smaller than a low-head turbine rated at only 3,420 h.p. There were many advantages in increasing the head range for each of the two main types of reaction turbine. Spectacular advances had already been made, and British engineers were now prepared to use Francis turbines, under favourable conditions, for heads in excess of 2,000ft. A major pumped storage scheme was already in operation at Sron Mor with the conventional arrangement of a separate pump, a separate turbine and a motor-generator coupled together as a single horizontal-shaft set. In a few years time a similar scheme would probably have the simpler reversible pump/turbine, provided the user was willing to adopt reversible units.

Owing to lack of time, it was intimated that the authors would reply in writing.

Electrically Equipped Kitchen

Mr. J. I. Bernard, in presenting his paper on "The Development of the Electrically Equipped Kitchen," interviewed Miss Marguerite Patten, well known for her television cookery demonstrations, against a background of domestic electrical apparatus introduced during the past year. Asked whether she thought that women in this country were ready to buy such appliances, she said that they did not buy "gadgets" for the sake of buying them, but wanted them to do a definite job in the home. Many women still did not realise how fast the modern boiling plate could be, but it was ease of control which was the most important requirement, to be able to get quick

1. *Mr. E. G. Teasdale.* 2. *Mr. A. Wilmot.* 3. *Mr. J. C. Beverley.* 4. *Mr. A. A. Fulton.* 5. *Mr. D. Clark.* 6. *Mr. J. A. Higgs.* 7. *Mr. P. L. Blackstone.* 8. *Mr. L. D. Anscombe.* 9. *Mr. A. Feiner*

1. Mr. J. I. Bernard interviews Miss Marguerite Patten. Speakers: 2. Mr. H. C. Timewell. 3. Miss C. Shirley. 4. Mr. T. Whittaker. 5. Mr. J. K. Webb. 6. Mr. A. Pendry. 7. Miss M. V. Griffith

boiling or a gentle simmer by a turn of the switch. She liked the eye-level grill, but thought it important that there should be a choice of position. There had been wonderful developments in automatic cooking, which was important not only for the "career woman" but for the mother of young children and for all with activities outside the home.

Before the war a great deal of time had to be spent in persuading people of the need for a refrigerator, but to-day they wanted one, and whether they bought it this year depended on good salesmanship and price. The increase in clothes washing in the home was partly due to the enterprise of manufacturers in introducing small and compact washing machines and also to the development of fabrics such as "Terylene."

Mr. H. C. Timewell said that to-day the United Kingdom appliance manufacturing industry had an annual output of about £160 million, but in the United States this industry came third in the economy with an output of $4,000 million, so that we had still a long way to go. Architects and builders were still reluctant to plan a kitchen for the maximum utilisation of floor and wall space. Manufacturers knew the limitations of existing kitchen space and many ingenious designs had been produced to meet the difficulty, but even the best were a compromise; what was wanted was a new concept of design for ease of living. The situation could be improved by a much more realistic attitude by building societies and insurance companies, who should be persuaded to include in their building loans and mortgages the essential items of built-in kitchen equipment. Building societies had not kept pace with the requirements of modern living and were still refusing to finance the completely equipped electrical house. There was a vast potential demand for all kinds of electrical appliances, and the resources of the electrical industry had still to be tapped to make it possible to live in dust-free homes, properly heated and ventilated.

Mr. W. N. C. Clinch (C.E.G.B.) pleaded for a reduction of purchase tax on so necessary a piece of equipment as the refrigerator, and even for its complete removal. He recalled that in 1931 Brighton had had the courage to build some electrically equipped houses, but this had led the gas industry to get Parliament to lay down the principle of freedom of choice.

Miss C. Shirley (English Electric Co.) said that the housewife, like all good craftsmen, depended on the tools available to her. The needs of the women in the home had been closely studied, and in many cases anticipated, by the electrical industry, which for many years had encouraged the participation of women in the development of domestic appliances. To-day, women home economists were employed by all the large appliance manufacturers and by the nationalised industry, and played a valuable part in perfecting the housewifes' tools for the job, working in close collaboration with the designers and influencing the functional and practical aspects of an appliance from the earliest prototype stage to the point where full production began. Women engineers with the necessary specialised technical training would also be welcome as members of manufacturing and design teams.

Full information on the practical and functional aspects of domestic appliances helped the public to discern for themselves good standards and high quality. For many years a comprehensive system of testing had been developed by E.D.A. and the Area Boards, using testing houses with special facilities to ensure sound standards. The recent emergence of well-intentioned consumer advisory bodies, each with its own conception of standards, might complicate this issue.

Mr. T. Whittaker (British Refrigeration Association) said that it should be made widely known that a modern electric kitchen was not a glamorous affair out of the reach of ordinary people, like a private swimming bath, but was within the reach of millions of people who ought to have it. The so-called ideal kitchen might discourage simple but adequate improvements in what was the most important part of the home. Over 90 per cent of the refrigerators in this country were electrically operated. During the last twelve months, for the first time the public had been buying refrigerators all the year round, instead of buying practically ceasing at the end of the summer months.

Mr. J. K. Webb said that one objection to electric cooking was still the delay due to thermal inertia. A problem in most kitchens was the heating of a single cup of milk or soup. He had experimented with small immersion type heaters, rated at about 500 W, which could be immersed in the cup, and to prevent damage by people forgetting to switch them off he suggested the use of a delay action switch which would cut the current off after two minutes. Such a switch should find many applications in the kitchen.

Mr. A. Pendry and Miss M. V. Griffith also took part in the discussion, to which the author briefly replied.

CONVENTION DINNER

Sir David Eccles, President of the Board of Trade, who proposed the toast of "The Electrical Industry" at the dinner held in the Corn Exchange on 19th June, said he did not claim to know anything about the technicalities of the electrical power industry, but whenever he went abroad and the subject of electrical equipment came up, as it often did, he always told the Government with whom he was having conversations that if they wanted value for money they must place their orders in Great Britain. Power in some of its forms, however, was very much the concern of politicians. "I believe in British power," he said, "because the record shows overwhelmingly that we have used it for just and peaceful purposes; but we must look at our changed position in the world to-day and decide what we are going to do about it. We have lost the power to 'go it alone.' We could retire from the First Division of the League of States and, like Sweden or Switzerland, live very comfortably, having got rid of some of our commitments and burdens, with no or little influence on the great international issues. I hope that we shall not take that way, but that instead we shall share our power with other countries and, by abandoning complete liberty of action, gain a greater say in world affairs through interdependence. The free world must organise its resources and apply them where they are needed, or we shall be outflanked in the economic war."

Education must be the foundation of the power of the West. The measure of this country's influence would be the strength of its economy; if we expanded steadily, other countries would more readily take our advice on how to conduct their affairs. Herein lay the importance of the electrical power programme at home and of the export of electrical plant abroad. The great success of the electrical industry was a guarantee of our national expansion and a demonstration of what we could do for others.

The free world must plan its economic expansion and see that it was maintained in all its territories. "If we fail to do so," Sir David said, "in ten years' time no one in a position of power in Asia or Africa will think our capitalist system superior to the Communist system." The strategic planning would have to be done by Governments, but the execution of the plan must remain in the hands of private enterprise. He asked whether the electrical industry was well enough organised in the free world to take a full share of responsibility for all three stages of expansion: planning, finance and execution? What more could the electrical industry do to assist the Governments to maintain orderly expansion throughout the non-Communist world? From the Iron Curtain to Vladivostock there were only two centres of power, one in Russia and one in China—one or two industries to meet the requirements of a thousand million people! Could we in the West, by voluntary agreement, compete with their centralised control? The brightness of the new day would depend on the uses to which power in all its forms was put. The British electrical industry was therefore right in the middle of the hope of the whole civilised world.

Sir George Nelson, who responded, said that when the supply of electricity was nationalised it was realised that a great future lay before the electrical industry as a whole, provided the closest collaboration could be established between research and development, manufacture, the user, and the supply industry. It was the inspiration of Lord Citrine which led to the establishment of the British Electrical Power Convention, which brought together forty associations in the industry to collaborate for the good of the industry as a whole. The Convention provided the industry with a great instrument for tackling some of the problems to which Sir David had referred.

The Convention had been discussing the export trade, and it had been clearly shown, from statistics compiled by the Board of Trade, that here the electrical industry was losing ground to America and Germany. This, however, should not be a cause of discouragement; it should inspire them to grapple with the problem, with the help of the Government. The industry could not recover its position by cutting prices; that would simply deprive it of the ability to carry out those services to which its present position was due. All sections of the industry must face the problem together; there must be more research, more rationalisation and greater efficiency in production. In all this the supply industry could play a great part. "I hope," Sir George said in conclusion, "that Sir David will help us in the steps which we take in rationalisation. He knows to what I am referring. With his help, we shall maintain the position that we have held in the past and improve on it in the future."

The toast of "Our Guests and Ladies" was proposed by Mr. J. R. Beard, past-president, and responded to by the Mayor of Brighton, Councillor A. J. Sadler.

ELECTRICAL FORUM

At the last session of the Convention on Friday the usual "Electrical Forum" was held, at which questions sent in by delegates were answered by a panel consisting of Mr. A. R. Cooper (regional director, Eastern, London and South East Region), Sir Claude Gibb (chairman and managing director, C. A. Parsons & Co.), Sir John Hacking (Merz & McLellan), Sir Christopher Hinton (chairman, C.E.G.B.), Mr. A. N. Irens (chairman, South Western Electricity Board), and Mr. W. H. McFadzean (chairman and managing director, British Insulated Callender's Cables, Ltd.), with the President as question master.

The first question was whether a free European market would result in the acceptance of British electrical practice on the Continent or of Continental practice in this country. Sir Christopher Hinton pointed out that each side was already in close touch with the other's practice, there were excellent arrangements for the interchange of ideas, and it was doubtful whether the free trade area would lead to greater uniformity in thought, in design and in technology than existed at present, and indeed whether greater uniformity would be desirable.

Mr. Cooper felt that one good thing which could emerge would be the adoption of the decimal system in this country. Common standard specifications would have to be agreed on, because otherwise no fair comparison between prices would be possible. On the same point, Sir Claude Gibb said that in general Continental standards of safety, reliability and performance were lower than British, but in Canada and Australia, for

The Forum Panel: Sir John Hacking, Mr. W. H. McFadzean, Sir Claude Gibb, the President, Sir Christopher Hinton, Mr. A. N. Irens and Mr. A. R. Cooper

instance, the Continental standard was often regarded as good enough and, as it probably involved a lower price, would be accepted. With a European Free Trade Area there would have to be a raising of some Continental standards (and there was evidence, particularly in regard to switchgear, of the need for this) and also a more realistic approach to the relaxation of some standards in this country, which would be a tremendous help to British manufacturers in world markets.

Another questioner asked why, in view of the need for more power station load between midnight and 6 a.m., the bulk supply tariff did not include a reduced rate for night load. Mr. Cooper said that for many industries electricity was so small a part of their total costs that a reduced tariff would have little effect, and night load would have to be developed by the supply undertakings themselves by thermal storage heating, pumped storage and so on. Sir John Hacking felt that automation would increasingly make three-shift working necessary apart from any tariff inducement. Sir Claude Gibb remarked that at least one Area Board appreciated the value of building up night load, and also enabled consumers who had under-floor electrical heating to allow the load to come on between noon and 3 p.m., which made thermal storage heating truly competitive with coal and oil. In the new machine shops which his company had just completed there was 4,000 kW of under-floor off-peak heating, the biggest installation of its type in the world. In new buildings now being put up his company would have electric off-peak water heating for supplying the batteries in front of circulating air fans.

Sir Christopher Hinton, speaking personally and not on behalf of his Board, expressed the view that the present bulk supply tariff needed careful examination with a view to modifications which would spur the Area Boards constantly to strive to retail their electricity in such a way as to improve the load factor. Mr. Irens said that the Area Boards had always been very conscious of the necessity to improve the load factor. There were large blocks of heating load at present using gas or oil. To get these marginal loads for electricity some special inducement was necessary, and for them there might be some special arrangement between the Area Boards and the C.E.G.B.

The next question was what was impeding cooker sales and pegging them down to about 200,000 a year, " barely a replacement figure." Sir Christopher Hinton, speaking as a householder, suggested that what made electric cooking less popular than gas cooking with some women was that they could not think five minutes ahead. If electric cookers could be devised which would anticipate the housewife's thoughts by five minutes it would overcome their main disadvantage. Mr. Irens, on the other hand, said that many manufacturers would be pleased to sell Sir Christopher a cooker which did not require five minutes' anticipation. The obstacles to greater sales were (i) cookers lasted a long time and did not require frequent replacement; (ii) the building programme had been slowed down; and (iii) for lack of capital the Boards had not been able to carry out the development work they would like to do. The younger generation liked electric cooking and on new estates three out of four chose it. It was a pity that we could not buy up all the old gas cookers and sell them in the West Indies, or somewhere.

Mr. Cooper said that the housewife liked to know whether her oven and hotplates were on or off, she wanted flexibility in the control of heat, and she did not want to be bothered by the question of the accumulation of stored heat. More publicity was needed, and designs which did away with the need for too much thought. The psychological aspects of electric cooking were as important as the technical.

A further question was whether service centres were really necessary for the display of electrical appliances when private concerns were rendering this service. Mr. Cooper maintained that they were both good and necessary. It was no reflection on the private trader to say that the Boards dare not sell anything second-rate because they had to live with the product, and, as their business was primarily the supply of electricity, the motive behind their sales of apparatus was rather different from that of someone whose interest ended with the sale of the article.

Sir Christopher Hinton, again speaking as a householder, regarded service centres as immensely valuable, because they could show a wide variety of types of good equipment, but he felt that they were sometimes too elaborate for customers to dare to enter them for a small purchase. Mr. Irens, after saying that in his Board's service centres there were " Woolworth counters " for smaller appliances, remarked that in the old days the professional engineer had felt that there was something not quite decent about trading, but now that the Boards had been told to go into the commercial side they intended to make a good job of it. Service centres would have to be provided in any case, and the sale of equipment enabled them to show a profit. In some Continental countries where State trading was not allowed the service centre was more like a mortuary. The present policy in this country was in the best interests of the consumer and did no harm to the private trader, who benefited when the Board conducted a drive for the sale of apparatus.

Sir Claude Gibb said that if he wanted to buy a cooker or refrigerator he found it very convenient to see the products of a dozen manufacturers at the service centre.

The next question suggested that disproportionate emphasis was being given to the need for more technologists, almost to the exclusion of the need for more and better salesmen. Mr. McFadzean emphasised the importance, for overseas trade, of a combination of the two; it was the sales engineer that this country should send abroad. Sir Christopher Hinton said it was a great mistake to build any industry into a technocracy; every industry should be properly balanced. The technical people must be sufficiently broadly educated to understand the view of the administrators; and the administrators should be well

enough brought up to sympathise with the view of the technologists. Sir Claude Gibb added that to sell nuclear power stations it was necessary to send overseas the leading designers and technologists who knew all about them, and Mr. McFadzean emphasised the need for whoever was sent having a knowledge of the country to which he was going, and its people.

To the allied question of whether business acumen or technical ability was more important in reaching a position of eminence in the electrical engineering industry, Mr. Cooper replied that three things were required of a leader in industry or anywhere else; he must be intelligent rather than clever; he should be interested in the way in which men's minds worked, because his business was not to make people do things but to make them want to do things; and he should have a healthy humility.

Another question asked whether the rate of electrification of the railways in this country was sufficiently rapid, in view of the congestion on the roads. It was pointed out that in the Netherlands one of the first tasks of reconstruction after the war had been to complete the electrification of the railways. Sir John Hacking took the view that the Netherlands had been right to give greater prominence to rail than to road development, while proceeding on some scale with both. Mr. McFadzean contended that in a densely populated country such as Britain the more that traffic could be moved by rail the better for all concerned. Sir Claude Gibb looked forward to the integration of electricity generation and rail transport once the railways had been electrified; when all goods traffic moved at night it would greatly improve the night load. While we had deferred too long the building of main trunk roads we should go ahead to the limit of our resources in money and man-power with the electrification of main line railways throughout the country. Sir Christopher Hinton said that when an improvement was known to be inevitable there were sometimes good reasons for carrying it out in advance of its absolute justification. There was no doubt that progressively the railways of this country must be electrified.

Mr. Cooper said that the railways were designed for the transport of heavy freights and the roads were not. There should be persuasion—he had almost said coercion—to move heavy traffic from the roads to the railways.

Yet another question concerned the desirability of simplifying domestic tariffs to consumers throughout the country by a national fixed block tariff. An example was given of 6d/kWh for the first 80 kWh and 1d/kWh thereafter. Mr. Irens felt it would be a great pity to have a common domestic tariff throughout the country, because the fundamental conception of an Area Board as a self-contained commercial enterprise was that it should have its own tariff. Mr. Cooper, on the other hand, believed that there was a strong case for looking into the possibilities of simplification. Arguments about "When is a room not a room," when the basis of the number of rooms was adopted, left the consumers bemused and suspicious. Sir John Hacking also felt that there was a case for the simplification of tariffs, though not necessarily for uniformity. The basis of tariffs all over the country could be the same, leaving it to the Boards to fix the price to suit their commercial policy.

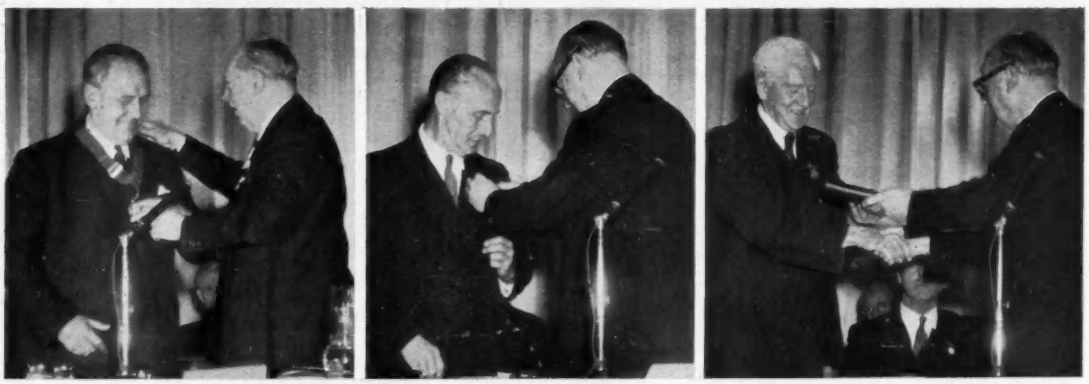
To the question of whether the panel considered it good practice to bond together the metalwork of all appliances and other metalwork with equipotential conductors, Mr. Irens replied that in his view it would be quite impracticable and that the alleged dangers were not such as to warrant the expenditure. The Boards were running into serious trouble where water pipes had been used because the water undertakings were going over to non-metallic pipes. Mr. Cooper felt the answer lay in insulation.

The last question, "What is the biggest single problem with which the industry is faced to-day?" evoked a variety of replies. In the view of Mr. Irens it was money, while Sir Christopher Hinton thought that the two outstanding problems were load factor and the use of nuclear power. Sir Claude Gibb did not believe there was a single major problem; he instanced among the most important the need for man-power of high quality, not only on the scientific side but in the machine shop and fitting shop, and human relations. In two years' time the major problem might be to keep full the factories which they had willingly expanded at the behest of the Government to cope with arrears of orders.

Annual General Meeting

After the formal business at the annual general meeting on 20th June, the President proposed the election of Mr. C. R. King, C.B.E. (deputy chairman of the Central Electricity Generating Board) as president for 1958-59, a proposition which was carried without dissent. Mr. King, in thanking the members for the honour which they had done him, said that when he became vice-president last year he was chairman of an Electricity Board and he regarded his election as recognition of the Boards and their staffs; he still took it this way.

Sir George Nelson invested Mr. King with the presi-



Left: Sir George Nelson invests Mr. C. R. King with the presidential badge. Centre: Sir Claude Gibb receiving the vice-presidential badge. Right: Presentation to Lord Citrine

dential badge and Mr. King in turn presented the past-president's badge to Sir George, thanking him and Lady Nelson for a very successful Convention. Next, Sir Claude Gibb was elected vice-president and expressed his determination to serve the Convention to the best of his ability.

Then Sir George Nelson, after announcing that the next Convention would be held at Torquay during the week commencing 1st June, 1959, moved a vote of thanks to all who had helped in the Convention.

Lord Citrine, in the absence of Sir Henry Self on urgent business, moved a vote of thanks to Sir George Nelson, saying that he was an industrial statesman who was concerned not only with his companies' welfare but also with that of the country. He was also an eminent industrial ambassador. Lord Citrine also expressed the Convention's thanks to Lady Nelson for the way in which she had helped to preside over the proceedings.

Sir George, in thanking the delegates, praised the work of Mr. J. W. Simpson, the Convention secretary, and his staff. He then went on to say that he was proud to have been a successor to Lord Citrine who not only conceived the idea of the Convention but put all his power of persuasion behind it to make it a success. On behalf of the Council he had great pleasure in presenting Lord Citrine with an inscribed leather writing case.

Lord Citrine, in expressing his thanks, said that he had been overwhelmed by the generosity with which he and Lady Citrine had been treated by the industry. He reminded his audience that the Convention, embracing all branches of the electrical industry, was unique in the world. He appealed to them not to let anything arise to end it, for it provided unlimited scope for the expression of the views of the industry, especially in the difficult days ahead. The annual meeting, and the Convention, then concluded.

Members of Council

The list of members of the Convention Council approved at the meeting was as follows; deputies' names are given in parenthesis:—

Area Electricity Boards, D. B. Irving, B.Sc., D. H. Kendon, B.Sc., and N. Elliott, O.B.E., J.P., M.A.; Association of Consulting Engineers, J. F. St.G. Shaw; British Electrical and Allied Industries Research Association, O. W. Humphreys, C.B.E.; British Electrical and Allied Manufacturers' Association, B. H. Leeeson, C.B.E., T.D. (D. M. Buist); British Electrical Development Association, W. N. C. Clinch (J. I. Bernard, B.Sc.); British Refrigeration Association, T. Whittaker; British Valve Manufacturers' Association, J. M. Storey (D. S. Gardner); Cable Makers' Association, A. H. Carmichael; Central Electricity Generating Board, F. H. S. Brown, B.Sc., and Ernest Long; Electric Lamp Industry Council, W. J. Jones, M.Sc.; Electric Light Fittings Association, D. L. Tabraham; Electric Vehicle Association of Great Britain, the Secretary (the Deputy Secretary); Electrical Association for Women, Miss Mary George, M.B.E. (Miss A. Lockhart); Electrical Contractors' Association, L. C. Penwill, C.B.E.; Electrical Contractors' Association of Scotland, I. Sclar (J. Smellie); Electrical Wholesalers' Federation, P. B. Etheridge (F. J. Blackwell); Electricity Council, C. T. Melling, C.B.E., M.Sc.; Electricity Undertakings in Northern Ireland, A. W. Ferguson, M.C. (R. P. Watson); Institution of Electrical Engineers, B. L. Metcalf, B.Sc. (W. K. Brasher, C.B.E., M.A.); National Inspection Council for Electrical Installation Contracting, A. F. Plummer, M.C.; North of Scotland Hydro-Electric Board, Sir Hugh Mackenzie, C.B.E.; South of Scotland Electricity Board, J. S. Pickles, B.Sc.; Staff Associations' Committee, A. M. F. Palmer, M.P. (L. G. Moser); Water-Tube Boilermakers' Association, K. J. McKillop (R. H. E. Gladstone).

Engineering in South Wales

AT the summer meeting of the Institution of Mechanical Engineers in South Wales two papers were presented on 18th June. One by Messrs. W. F. Cartwright and J. F. Scott-Maxwell described "some mechanical equipment in the heavy industries" of that area. The industries covered were mainly those concerned with new colliery winders, power supply and chemical and metallurgical processes. At Cwm colliery a double (balanced) 12-ton skip winder can raise 500 tons/hr from a depth of 2,240ft in an automatic continuous process. The skip door is pulled open at the surface by electromagnets. The engine is driven by a 3,000-6,000 h.p. a.c. slip-ring motor. At Abernant colliery two multi-rope friction tower-mounted winders are each to have a 2,000-4,000 h.p. Ward-Leonard drive to raise coal from 1,440ft (200 tons/hr) or 2,640ft (160 tons/hr).

During the first nine years the installed capacity of electricity generating plant in South Wales rose from 553 to 1,397 MW while the number of power stations fell from 23 to 11 with an improvement in thermal efficiency from 20·8 to 24·8 per cent. Two new stations under construction by the C.E.G.B. are Aberthaw (six 100 MW reheat sets) and Uskmouth "B" (three 120 MW reheat sets). At Margam iron works a 240 klb/hr forced-feed once-through Benson boiler is being installed to drive a 9·5 MW back-pressure turbo-alternator and to provide 200 klb/hr of process steam; steam conditions will be 3,300 lb/sq in and 1,060 deg F with reheat to 836 deg F at 628 lb/sq in. It will be fired by blast-furnace gas (90 per cent) and oil (10 per cent). Overall thermal efficiency is expected to be nearly 33 per cent compared with 25 per cent for a 600 lb/sq in condensing unit.

In the second paper, Mr. H. A. V. Bullard dealt with representative examples of light mechanical engineering in South Wales, which included manufacturing particulars of "Hoovermatic" washing machines having electric water heaters and high-speed spin drying, in which opening the lid switches off the motor and applies a friction brake. Design details of the "Stantec Zebra" electronic digital computer using printed circuits were also given.

750 kV Transmission

CONSTRUCTION will start next year on a 4½-mile length of a prototype 750 kV transmission system near Pittsfield, Massachusetts, by the General Electric Company of America. Preliminary plans include portal type towers of 10ft square boxed girder construction. The uprights will be 160ft high and the cross-member 180ft long. Horizontal phase configuration will probably be used with 20ft insulator strings. Two overhead earth wires will be located on top of the cross-member, midway between the phases. It is planned to energise the open-ended line in early 1960, initially at 460 to 500 kV. Terminal equipment will be installed in the summer of 1961 and the line will begin to carry loads up to 40 MVA at 600 to 750 kV. After actual operating experience has been obtained the whole project will be reassessed in the summer of 1963.

It is hoped that this project will lead the way to a trans-continental grid system in America and that the U.S.A. will recapture the e.h.v. transmission field from the U.S.S.R.

PARLIAMENTARY REPORT

Higher Initial Allowances

During the committee stage of the Finance Bill, the Chancellor of the Exchequer, Mr. Heathcoat Amory, announced that he had decided to change his proposals for increasing initial allowances, in order to give practical encouragement to industrial investment. He now proposed to amend the Bill so that the allowances would be increased by one-half instead of one-quarter. The effect would be to raise them to 30 per cent for plant and machinery, and 15 per cent for industrial building. The increase would date from Budget day.

M.P.s taking part in later discussions congratulated the Government for their flexible approach to the economic situation, and for a decision which was a move forward towards steady expansion. Some members declared it would have been better if the Chancellor had given industry investment allowances and not initial allowances.

Hydro-Electric Costs

Sir James Hutchison asked the Secretary of State for Scotland how the costs per kW installed of the Strathfarrar and Kilmorack scheme compared with earlier schemes, and for what area of Scotland it was expected to provide electricity.

Mr. J. S. Maclay said the estimated cost was £140 per kW installed compared with an average of £137 per kW for all the schemes completed by the North of Scotland Hydro-Electric Board. The scheme was an integral part of the Board's programme which was designed to meet the steadily growing load in its area and to give peak supplies to South Scotland.

Air Traffic Control

Mr. Watkinson, Minister of Transport and Civil Aviation, said he had authorised an extensive modernisation plan for Britain's three Air Traffic Control Centres. Under this plan, aircraft using the airways would be under continuous radar surveillance throughout flight over this country. The Ministry were already examining proposals submitted by the radio industry for new radar and remoting equipment to meet this requirement. Improvements were also being made to the control facilities at our major airports. The capital cost would be about £5 million spread over the next five years.

Rail Communication with London Airport

Mr. Marcus Lipton asked the Minister of Transport what progress had been made in providing improved rail communication between London Airport and Central London.

Mr. Airey Neave said they were awaiting detailed proposals for monorail systems. Before a conclusion was reached the Minister would need to compare these systems with the scheme for a conventional rail link. He would also need to take into account the large capital expenditure involved and the possible effects on rail traffic of the construction of a new motorway.

East-West Trade

In a debate on East-West trade in the Commons many M.P.s appealed to the Government to take firmer action to get a revision of the strategic embargo lists drawn up by the Western Allies Co-ordinating Committee in Paris.

Mr. Harold Wilson said that owing to the attitude of COCOM, we were in danger of losing orders for plant and machinery adding up to about £150 million. The Russians were going to buy anyhow, and the Germans had no inhibitions.

Mr. Mikardo said that export trade in electrical machinery, apparatus and appliances had been considerably enlarged but there had been a notable slackening in the last few months. We could not afford to waste any opportunities for export sales. In the first four months of 1955 we sold to Russia just under £700,000 worth of electrical machinery, apparatus and appliances. In the first four months of 1956 that went up to £1,147,000. In the first four months of 1957 it dropped back to practically the 1955 figure and was just over £600,000. In the first four months of this year it was £160,000 —a quarter of last year's figure.

Mr. D. Ormsby-Gore, Minister of State for Foreign Affairs, replying to the debate, assured the House that the Government wanted the relaxation of artificial barriers to trade, and that they were taking all the steps open to them to reduce the list of strategic restrictions to the lowest level commensurate with national security. As for trade with the Soviet Union, it was especially disappointing that the flow had not increased much more, when one remembered the "shopping list" of goods worth between £800 million and £1,000 million that Mr. Khruschev and Mr. Bulganin put forward two years ago. Although about two-thirds of those items were outside the strategic restrictions, in 1957 the Soviet Union purchased only £52 million worth of goods from the U.K. In the same year the U.K. imported £71 million worth of goods from the Soviet Union. It would be misleading and perhaps over-optimistic to assume that we could hope for a very great increase in trade with Eastern Europe or China in spite of the undoubted size of the potential markets.

It was his hope that the present review of the strategic restrictions would be concluded this summer, and he believed it would result in freeing an important range of goods.

Runway Lighting at Southend Airport

A new high intensity runway lighting system, designed by the General Electric Co., Ltd., has recently been installed at Southend Airport. It is the first installation of its kind on any civil airport in Britain.

The ZA.105 lighting unit employs a heat-resisting single-piece glass refractor giving a bi-directional high-intensity light distribution, together with an omni-directional component. When used with the "Osram" 200 W series burning lamp it provides a maximum intensity in the main beams of 35,000 candelas and an average omni-directional component of 3,000 candelas. In spite of the comparatively large light source, it has been possible by careful design to limit the height of the unit above ground to meet the operating requirements of modern aircraft.

Southend Airport was raised to international standard last year when two paved runways, taxiways and apron were provided and a complete G.E.C. lighting system was installed. The new runway system now permits the very fullest use of the high-intensity approach lighting and radar approach aid in bad visibility conditions which occur from time to time throughout the year.

The runway lighting is operated by an entirely new system of remote control employing G.E.C. d.c. "Multiplex" equipment. Four channels, each consisting of a transistorised transmitter and receiver, are used at present to provide five steps of brightness control and monitoring on a single pair of wires, but the same pair could accommodate additional channels for up to eight further control or monitoring circuits.

Provision has been made also for installing two high intensity angle of approach (glide path) indicators later in the year. These units are high intensity versions of the conventional three-colour units already installed and are designed to operate with 2 kW "Osram" projector lamps.

The installation of the new equipment, all of which was supplied by the G.E.C., was carried out by C. Maurice Contractors, Ltd., Bishops Stortford.

INDUSTRIAL NEWS

Electricity Supply "Productivity Allowance"

In reply to the trade unions' claim for an increase in the wages of manual workers, the National Joint Industrial Council for the Electricity Supply Industry last week agreed that a productivity allowance of 8s 3d per week should be paid to all manual employees with one month's service or more. The allowance, which would be payable with effect from the first full pay period following 1st May, would be regarded as distinct from the wage rate and be paid as a weekly sum in addition to overtime and any other special allowances. The trade unions would collaborate with the Electricity Boards in examining and promoting all means of achieving further improvements in the productivity of the industry and the continuing development of the efficient use of manpower. Apprentices and other juveniles would receive appropriate treatment on a percentage basis and the Foremen's Sub-Committee of the N.J.I.C. would consider an appropriate productivity allowance for foremen. A review of the differential rates of pay for craftsmen would be initiated at a meeting of the N.J.I.C. in October next.

Mr. C. T. Melling, chairman of the Boards' side, said that the settlement was designed definitely as a non-inflationary award intended to secure increased productivity and more efficient use of manpower. Wage rates were unaffected. The Boards had been unable to concede the arguments which had been put forward by the trade unions in regard to the cost of living.

The Boards recognised the part that the trade unions had played in the past, and believed that further collaboration would enable the industry to realise the opportunities opened up by modern improvements in design, technology and operation. The financial advantages of these improvements were increasingly necessary to provide for adequate contributions to the forward capital needs of the industry, while ensuring that a proper share of the benefits passed to the consumer. The Boards were satisfied that the achievements in productivity already made and in prospect warranted the productivity allowance now agreed, which amounted to somewhat under 3½ per cent on the total wages bill for the employees concerned.

Mechanical Handling Plant for Northfleet Power Station

A contract, of a total value approaching £1 million, has been awarded to Babcock & Wilcox, Ltd., by the Central Electricity Generating Board, for the whole of the coal, ash and dust-handling installation to serve the new Northfleet power station, near Gravesend, Kent. This installation will serve ultimately a total of six pulverised-coal fired boilers, each supplying steam to a 120 MW turbo-generator. The coal plant, with a capacity of 1,600 tons per hour, will handle the seaborne coal from the Thames quayside, via belt conveyors, to the boiler house or out to the coal store. The dust-handling system, capable of dealing with 210 tons per hour, will convey the dust from the dust-collection points over a distance of 2,600ft to the storage bunkers, where it will be wet-conditioned for disposal by lorry.

Government Lead Stockpile

The Board of Trade sold 6,700 tons of lead between January and June this year. There will be no further offerings of lead from the stockpile for the time being and an announcement will be made before sales are resumed.

First Kariba Turbine

The major parts of the first 140,000 h.p. Francis turbine for the Kariba hydro-electric power station have recently been dispatched to Rhodesia ahead of schedule. Six turbines for this power station, with a total output of 840,000 h.p., are being supplied and erected by Boving & Co., Ltd., London, and manufactured at the works of Markham & Co., Ltd., Chesterfield.

The recent shipments, weighing over 270 tons, comprise the stayring, spiral casing and guide apparatus but exclude the rotating parts of the turbine which are not required until a later stage of the erection programme. The first draft tube liner has already been assembled at site ahead of programme by Boving's erection staff and it is hoped to begin installation of the remainder of the turbine early in August when the concreting of the foundations will have been completed.

In the meantime, work is proceeding on the erection of the draft tube liners for the following turbines. The first generating set is scheduled for commissioning by 1st January, 1960.

Six turbines for the Kariba hydro-electric scheme, with a total output of 840,000 h.p., are being supplied and erected by Boving & Co., London, and manufactured at the works of Markham & Co., Chesterfield, where the first stayring and guide apparatus are shown assembled

R. B. Pullin Acquisition

R. B. Pullin & Co., Ltd. has acquired the thermostat business of Cyril Kieft & Co., Ltd., and the Kieft range of thermostats is now being manufactured within the Pullin Group. Sales are being handled by the parent company, R. B. Pullin & Co., Ltd., at Phoenix Works, Great West Road, Brentford, where the company's research and design resources will be used for the expansion of the present range and the production of new types for industrial and domestic heat control applications.

Amplifier for Eurovision Link

A new output amplifier stage has been installed by the General Electric Co., Ltd., in the transmitter of the B.B.C.'s 2,000 Mc/s "Eurovision" T.V. link at Swingate, near Dover.

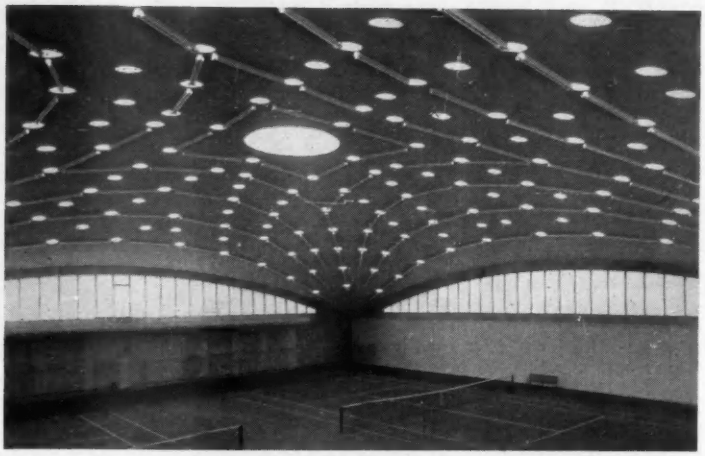
The amplifier is expected to improve the picture signal received under adverse conditions in France, and increase the output power of the transmitter to 20 W. It uses the G.E.C.'s new travelling wave amplifier (TWS 1), which was specially developed in the company's Wembley Research Laboratories. The TWS 1 is convection-cooled, an unusual method for a valve of this power and type.

Covered Courts at Wimbledon

Two covered courts have just been completed at the All England Lawn Tennis Club, Wimbledon, which will be used as practice and coaching courts.

In order to avoid internal supports a concrete "handkerchief" dome has been constructed, supported only on four columns at the corners, and forming in effect a permanent umbrella. The area covered by the dome is 15,200 sq ft. The structure has been designed to give a maximum of natural light and this is provided by glazed segmented openings on the four sides, 200 small roof lights set along the minimum principal stress trajectories, and a large central lantern covered with a 14ft diameter "Galt Glass" dome.

Full artificial lighting is provided, the scheme being designed by Philips Electrical, Ltd., who also supplied the



The new covered courts at the All England Lawn Tennis Club, Wimbledon, showing the fluorescent lighting in the domed roof

fluorescent lighting fittings. These consist of 8ft 125 W "warm white" fluorescent lamps fixed along the maximum principal stress trajectories, with an intensity of 40 lumens/sq ft. The necessary wiring has been incorporated for the intensity to be increased to 60 lumens if needed. The contactor equipment will permit three-stage switching.

The main contractors for the construction of the courts, including the electrical installation, were W. H. Gaze & Sons, Ltd., in conjunction with Formcrete, Ltd. The consulting engineers were C. J. Pell & Partners.

Transformer Banks for Snowy Mountain Project

C. A. Parsons & Co., Ltd., have received a contract for seven single-phase generator transformers for the Snowy Mountain Hydro-Electric Authority, Australia.

The transformers will each have a rating of 50 MVA, being designed to operate in two 3-phase banks with one unit acting as a standby. Each bank will transform the output of two generators through independent delta-connected l.v. windings, and will step up from the generator voltage to the transmission system voltage of 330 kV. The transformers are to be provided with cable boxes for direct connection to 330 kV cables and will employ cooling systems of the O.F.W. type. When completed the transformers will undergo a comprehensive series of routine and type tests, including both heat runs and impulse tests at 1,300 kV.

"Electric Lighting"

The British Lighting Council has published the first number of *Electric Lighting*, successor to *Lighting Service*, the organ of the former Lighting Service Bureau, whose role has been taken over by the Council. It contains a number of well-illustrated articles on various aspects of lighting promotion, including "The Rest of the Building" (lighting of corridors, stairways, etc.), rules for good lighting, a selection of lighting fittings, and "Son et Lumière."

Further Diesel-Electric Locomotives for Ghana

A contract has just been signed for the supply of a further twelve 750 h.p. Bo-Bo diesel-electric locomotives to Ghana Railways by the English Electric Co., Ltd. Fourteen similar units, the first diesel-electric locomotives to operate in Ghana, were supplied by the English Electric Co. in 1955 and these have now been well tried in service on shunting and transfer duties and as single units on light passenger and freight duties. They also operate in multiple unit on the heavier main-line services.

The locomotives, which weigh 53 tons in working order, are powered by English Electric six-cylinder SKRT type diesel engines manufactured at the company's Preston works. Maximum service speed is geared to 55 m.p.h. The locomotives now ordered will be built by Robert Stephenson & Hawthorn, a member of the English Electric Group.

New Conduit Company

Greenwood's & Airvac Ventilating Co., Ltd., has formed a separate organisation to take over the design, development and marketing of the conduit division of its business. From 1st July the title and address of the new associated company will be Greenwood Airvac Conduits, Ltd., Carlisle House, 8, Southampton Row, London, W.C.1.

Medical Colour Television Unit

A mobile closed-circuit colour television unit ordered from Marconi's Wireless Telegraph Co., Ltd., by Smith Kline & French Laboratories, Ltd., was officially handed over on 4th June. It is the intention of Smith Kline & French to place this unit at the free disposal of medical authorities in this country for use at conventions or similar functions. It will be used, for example, to televise, in full colour, clinical procedures and intricate operations being carried out by specialist surgeons in order to demonstrate their methods to a large body of surgeons or students in a nearby hall. A detailed commentary is given through the associated sound channel.

The van contains all the equipment used for a colour demonstration. Most of the control and switching equipment is permanently mounted and operated from the van. Camera projectors, microphones and cables are transported in the van and set up on arrival. In surgical demonstrations the compact colour camera is mounted on a mobile pedestal a few feet from the operating field and shoots horizontally at a tilted mirror suspended immediately above the operating field. The image is, of course, a mirror image but is corrected electronically in the camera. In medical demonstrations the camera normally shoots directly and no correction is required. A surgical or medical procedure in an area of about 1 sq ft can be magnified on the video screen to about 48 sq ft with all details of techniques, no matter how fine or intricate, clearly visible to the audience.

New Switchgear Works

Production is now in full swing at the new factory which Peppers of Woking, Ltd., has opened in Stanhope Road, Camberley, Surrey, to provide increased facilities for the manufacture of its special purpose low voltage switch and control gear, and high voltage switchgear up to 275 kV. The new premises have double the production capacity of the old works at Woking. Originally, it was intended to close down the old works, but demands have made it necessary for the re-opening and it is now again in full production.

A feature of the new factory is that

The test room at the new works of Peppers of Woking, Ltd., at Camberley

it is practically self-contained. As the company designs and makes a good deal of equipment to customers' own requirements, these facilities make it possible to reduce production time substantially and meet any emergencies that may present themselves. The drawing office, design and estimating departments and a well-equipped toolroom caters for the most complicated equipment. A range of power presses up to 20 tons capacity with a wide variety of modern equipment meets the needs for sheet metal fabrication and component production. In inspection and testing, the same system of quality and batch control is employed for the company's commercial work as for aeronautical inspection. Apart from switch and fuse gear and general engineering work, the company specialises in the solution of conduit and pipe coupling problems and can provide adaptors to meet all requirements, in particular, standard and non-standard threads. It also produces all the outdoor connector equipment and other items for power installations of its associate company, Power Connectors, Ltd.

New Aluminium Foil Division

At a meeting held in London recently Mr. L. G. Rich (joint managing director, Venesta, Ltd.) announced the formation of the Venesta Foil Division, completing a plan of co-operation and co-ordination between Venesta, Ltd., and the Empire Aluminium Co., Ltd., to meet the growing demands for aluminium foil which have risen from 4,500 tons in 1946 to more than 21,000 tons last year. In the electrical industry aluminium foil is used for capacitor winding, cable wrapping and transformer coil winding. It is estimated that the alliance produces some 40 per cent of all foil rolled in Great Britain, and meets more than 45 per cent of foil exports.

B.T.C. Install an Analogue Computer

The British Transport Commission has installed an analogue computer in the office of the chief electrical engineer, British Railways central staff, to provide advance details of train performance with the new forms of motive power which are being introduced under the railway modernisation programme. This information will be used to compile revised timetables designed for the maximum utilisation of electric and diesel-powered locomotives and trains.

Air-Conditioned Room at Ferranti Works

All Ferranti instruments are now assembled, calibrated and tested in an air-conditioned room specially built for the purpose in the Moston factory. Completed in March last, the room occupies an area of approximately 4,000 sq ft and has a capacity for handling 6,000 instruments per month. Filtered air is passed over a steam-heated radiator and the temperature in the room is maintained at 68 deg F by thermostatic control. Air is admitted to the room through baffle vents fitted to the false ceiling at the rate of ten to twelve complete changes per hour. All the components are passed into the room via an air lock in which they are cleaned by means of an ultrasonic process.

Personnel are provided with weekly - laundered nylon overalls and overshoes. Entry and exit are made via two ante-rooms. Outdoor clothing is removed and kept in the first of these whilst the second ante-room acts as an air lock and a cloakroom for the overalls and overshoes. Good shadowless lighting is provided by double banks of fluorescent tubes. The general lighting is supplemented by individual bench lighting at various points as needed. The room is equipped with modern apparatus specially built for calibrating, testing and dial marking the many types of Ferranti instruments in current production.

The air-conditioned room for instrument testing at the Ferranti Moston factory

Motor Control Gear Makers' Golden Jubilee

The Electrical Apparatus Co., Ltd., was founded in 1908 by Mr. Ernest Schattner, M.I.E.E., and Mr. Richard Amberton, M.I.E.E., and last week the company held two open days to mark the golden jubilee. On the first day the Mayor and Mayoress of St. Albans and over 140 representatives of the company's customers and suppliers were entertained to lunch in the main hall of the modern clubhouse adjoining the works. The second day was for employees and their families. The history of the company has been recorded by Mr. J. Grisdale in an attractively-designed brochure which contains some fascinating photographs of early equipment.

The E.A.C. commenced their activities at the Milford Works, Battersea, London, with the manufacture of motor control gear, enclosed fuses, switchgear of various designs, regulators for cinema arc-lamp projectors, and a commutator-type quarterly meter. An interesting domestic prepayment meter of this period was of the electrolytic type originally designed and manufactured by Mr. Schattner in 1897, when he was with the Norwich Electricity Company. In a modified version the consumer's lights were dimmed and not cut off when his shilling's worth of electricity had been used; but the dim light was paid for by the next shilling.

Expanding demand for the company's products necessitated a move to larger premises, and in 1911 a new works was built at Vauxhall with facilities for 250 employees and space for extensions for a further 200. After the first war these were again to prove insufficient and in 1920 the buildings forming the nucleus of the present works and offices at St. Albans were completed. The whole of the company's activities were not moved to St. Albans until 1938.

After the last war restrictions on building and shortage of labour precluded further extension at St. Albans, and a factory was acquired at Oulton Broad, Suffolk. This was equipped from the outset for the flow-production of standardised types of apparatus and it also contains a mechanised iron foundry. Work on non-standard apparatus and the ever-increasing number of "tailor-made" control panels has been concentrated at St. Albans, where there is also a section producing voltmeters and ammeters. More recently extension of the St. Albans works has become possible, and building to increase the technical office facilities is now in progress.

The company at present employs some 500 workpeople and 200 staff at St. Albans and there are a further 300 at Oulton. Mr. R. H. Barbour, M.A., M.I.E.E., the chairman of the company, joined the board in 1910 and he succeeded Mr. Schattner as chairman in 1919. He was also managing director from that date until 1945 when the present managing director, Mr. J. R. Walton, M.I.E.E., took over. In addition to the chairman, twenty-four employees, including two other directors, have been with the company more than 40 years, and 80 people still working for the company have received awards for 25 years' continued service.

World's Second "Package" Reactor

A "package" nuclear reactor similar to the one already successfully operating near Washington, D.C., is to be built for Alaska's first atomic power plant. It is expected to be ready in

1960. It is being erected for the United States Army Corps of Engineers at Fort Greely, near Fairbanks.

The entire nuclear system is to be designed and built by ALCO Products, Inc., who were responsible for the Washington reactor, it was announced in London recently by Humphreys & Glasgow, Ltd., who hold rights for these plants outside North America. This pressurised water reactor will be known as the APPR-1a, in distinction to the APPR-1 at Washington, which has been operating since April, 1957, with an electrical loading of 2,000 kW.

The Alaska plant will have a thermal output of about twice that of the APPR-1, though the reactor core will be the same size. Half its output will be used to generate an electrical load of 1,700 kW. The rest will be used for space heating. The plant will provide all the electric power normally consumed by the Army post there, which is a cold weather training station and a service post.

Fabrication and construction of the Alaska plant was put out to public tender. ALCO secured the contract for furnishing all primary-system components together with the nuclear instrumentation and fuel-handling equipment.

Winding-Up Petitions

In the Chancery Division on Monday Mr. Justice Wynn-Parry made an order for the compulsory winding up of Pena Industries, Ltd., on the company's own petition.

A petition for the compulsory winding up of Peto Scott Electrical Instruments, Ltd., was adjourned for seven days.

Royal Highland Show

Of particular electrical interest at the Royal Highland Show held from 17th to 20th June was the comprehensive display of the South of Scotland Electricity Board. The display comprised a range of electrical equipment for use in the dairy, the barn, for crop conservation and for pig and poultry rearing, and a demonstration of mist propagation. A section of the exhibit which attracted considerable attention was "Electricity's Ultra-Modern Farm House," in which the Board endeavoured to show some of the future electrical developments which might influence farm life. This display included the "ultra-modern farmer's den," shown in the accompanying picture, from which the farmer could maintain complete control and check work being carried out on any part of the farm. The equipment included T.V. screens and an equipment control panel to show at a glance every piece of equipment in use or immediately available for use on the farm.

The "ultra-modern farmer's den," which formed part of the South of Scotland Electricity Board's display at the Royal Highland Show

Drafting of Purchase Order Conditions

The Purchasing Officers' Association, Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4, has published a booklet, "Terms and Conditions of Purchase" (price 5s post free), which has been prepared as a guide, in the short term, to its members in their efforts to establish fair trading terms for both buyers and sellers and, in the long term, to provide a basis for the establishment of a set of standard conditions agreed nationally between buyers and sellers. It discusses points which require consideration in framing a contract for the purchase of goods, sets out a draft model set of standard conditions of contract, and suggests a form of procedure for use in purchasing offices for the handling of orders.

Oldham Foremen's Conference

Over eighty members of Oldham & Son, Ltd., attended the eighth foremen's conference at Grange over Sands recently. The subjects dealt with included the duties of a mining agent; selling replacement batteries; elements of cost; the problem of supply; and final inspection.

Plastic Liners for Refrigerators

A new film on the production and applications of "Saroy," a high impact polystyrene sheet manufactured by Saro Laminated Wood Products, Ltd., was shown to the Press last week. The film is photographed in colour, and after an introduction to the firm and its parent company, Saunders-Roe, Ltd., it deals briefly with the production of the raw material, Styron 475, at the works of Distrene, Ltd. The manufacture of the sheet at the Saro factory at Cowes is next followed in detail and there are some interesting examples of the methods employed for testing and quality control. The film ends with a survey of the uses to which "Saroy" is at present being put and of the ways in which it can be formed, printed, bonded and welded. A growing application in the electrical industry is for the door liners and complete interiors of refrigerators.

Price Reductions

Nettle Accessories, Ltd., has announced reductions in the prices of certain of its one-gang switch sockets.

Remploy Agreement

Remploy, Ltd., has announced that its sponsorship arrangement with the Igranic Electric Co., Ltd., Bedford, is to be extended. About a year ago Remploy entered into an agreement with the Igranic Co. to assemble some of its small auxiliary switches. Remploy's workers are now to assemble this company's new range of heavy duty oil-tight control units.

Trade Announcements

Nettle Accessories, Ltd., has appointed Mr. J. A. Morden as sales representative in the South Eastern Electricity Board area. He will work from the company's London depot at 20-22, Craven Road, London, W.2. The company states that it has now been established with the authorities that architectural fitting Nettle Ref. No. 506X (page 18 of price list No. 28) will no longer be subject to purchase tax.

The **British Central Electrical Co., Ltd.,** has appointed Mr. J. L. R. Wilkinson as technical sales representative for its North-Western Area.

Mr. H. H. Ash, representative of the lighting division of **Philips Electrical, Ltd.,** in North Wales, is to retire from the company's service on 30th June. From that date his duties will be taken over by Mr. G. T. Jones.

The Newcastle area stores of the **A.E.I. Lamp & Lighting Co., Ltd.,** at Tennant Street, Stockton-on-Tees, have been moved to premises in Short Street, Middlesbrough.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 4th July:—

MAEKER. No. B753,287, and MAEKER (design). No. B753,288. Class 9. Apparatus for controlling the action of machine tools by means of electric current control; and electric switches.—K. Maeker and H. Maeker, trading as Elan-Schaltelemente Kurt Maeker o.H.G., Dusseldorf, Germany. Address for service, c/o Stanley, Popplewell, Francis & Ross, Cursitor Street, London, E.C.4.

MESSA (design). No. B765,977. Class 9. Electronic apparatus; television receiving apparatus and aerials, etc.—A. P. J. Knegtel, trading as Messa Electronics, Rotterdam, Holland. Address for service, c/o Gill, Jennings & Every, 51-52, Chancery Lane, London, W.C.2.

CRITIQUE. No. 774,770. Class 9. Radio sets and television sets, all sold complete; and sound reproducing apparatus and instruments.—L. R. T. Tyley, 11, Grove Park Terrace, Chiswick, London, W.4.

GENERATION AND DEVELOPMENT

Electricity Output and Sales

The monthly statement issued by the Ministry of Power (Table 1) shows that 7,324 million kWh was generated in May by the three public supply authorities—the Central Electricity Generating Board, the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board. The rate of increase, 1·1 per cent, was lower than in recent months, partly because Whitsun occurred in May this year and in June last year. At the end of the month the total installed plant capacity was 26,996 MW, representing a net addition in May of 184 MW (C.E.G.B. 160 MW; S. of Scotland Board 24 MW). The new plant installed in C.E.G.B. stations included the following:—

Brighton "B": 34 MW-equivalent boiler (Babcock & Wilcox). Castle Donington: 100 MW set (Metropolitan-Vickers) and 100 MW boiler (Babcock & Wilcox). Hams Hall "C": 60 MW set (G.E.C.) and 60 MW boiler (Simon-Carves).

In addition to the public supply, 816 million kWh was generated by industry in the four weeks ended 24th May last, an increase of 2·9 per cent. This included approximately 38 million kWh produced at the Calder Hall nuclear power station.

Table 2 analyses the sales of the Area Boards in England and Wales. The national figures show an increase over May, 1957, of 1·2 per cent but, when corrected for weather conditions and working days, the increase is 7·1 per cent.

Farm Tariff

A new tariff for electricity used for farming purposes is to be introduced by the South Western Electricity Board from the first normal meter reading following 29th June. Announcing this in Bristol last week, a Board spokesman said that in future supplies would be charged on a two-part tariff with a running charge of 1½d/kWh. There would be no change in the charges made for supplies for domestic purposes in the farm house.

The new tariff had become necessary because of the considerable number of farmers who used little or no electricity for farming processes but for whom the Board had undertaken very heavy capital expenditure. "We have to ensure that farmers who make only a limited use of electricity on the farm pay a fair contribution to the costs of providing the supply," he said. The tariff would not increase the charges paid by farmers who were already putting electricity to reasonable use.

Under the new tariff, on an average farm with a farmhouse of five to eight rooms supplied through one meter, the quarterly electricity bill would be: Fixed charge £3 5s; first 60 kWh at 7d/kWh; next 60 at 2½d/kWh; all in excess at 1½d/kWh. For the same property but with separate metering the quarterly account would be:—Farm: fixed charge £3 5s; all kWh consumed for farming purposes at 1½d/kWh. Domestic consumption: first 60 kWh at 7d/kWh, next 60 at 2½d; all in excess at 1½d.

Claim for Earthing Rejected

The Runcorn Urban Council has rejected a claim for £159 18s made on behalf of an electrical contractor for additional work undertaken in providing earthing wires in 312 dwellings on the Russell Road Estate. The surveyor reported that before Mr. Taylor's tender was received the Merseyside and North Wales Electricity Board had issued a circular to all electrical contractors advising them of the Board's earthing requirements.

Council Favours Overhead Line

Wigton (Cumberland) Rural District Council is to make a "strong protest" against the decision of the Ministry of Power authorising the placing of part of an electric cable underground between Caldbeck and Sandale, pointing out that there is already a television mast in the area 500ft high. The Council believes that if the cable were erected above ground, properties en route could be supplied with power, but with underground cable there would be little prospect of this being done.

Yorkshire Consultative Council

At a meeting of the Yorkshire Electricity Consultative Council at Wakefield a letter from the Board was read which stated that if no further increase in the prices of commodities occurred there was every possibility that tariffs would not be further increased before 31st March next year. When the new tariffs were put into operation in April, 1957, it was then stated that it was hoped they would remain stable for two years.

Although the Board was criticised for ending its radio and television sales service without making arrangements for repairs, the Council agreed to accept the position as reported by the Board, Ald. W. Leach, of Barnsley, stating that the Board had taken its

TABLE 1.—ELECTRICITY GENERATED AND SENT OUT FOR PUBLIC SUPPLY

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B.	3,161	68	159·8	6,700	8	6,714	6,296	24,595
North of Scotland H.E.B. ...	8	—	1·2	14	125	145	143	912
South of Scotland E.B.	236	7	0·2	453	12	465	440	1,489
Total for May, 1958	3,405	75	161·2	7,167	145	7,324*	6,879	26,996
Corres. total for May, 1957 ...	3,631	73	59·3	7,125	113	7,248	6,805	24,962
Inc. or dec., per cent	−6·2	+3·4	+171·9	+0·6	+28·5	+1·1	+1·1	+8·1
Total to date (5 months), 1958...	20,901	444	689·3	42,489	972	43,535	40,984	
Total for corres. 5 months of 1957	19,668	397	130·9	38,002	1,014	39,072	36,750	
Inc. or dec., per cent	+6·3	+11·8	+426·7	+11·8	−4·2	+11·4	+11·5	

* The total figure includes generation by other methods amounting to 12 million kWh.

TABLE 2.—ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for May (million kWh)			Twelve Months Totals Ended 31st May (million kWh)		
	1957	1958	Inc. or Dec. %	1957	1958	Inc. or Dec. %
London	548·0	522·8	− 4·6	6,941·4	7,497·4	+ 8·0
South Eastern	356·0	377·5	+ 6·0	4,454·2	4,958·5	+11·3
Southern	449·2	475·1	+ 5·8	5,505·4	6,237·1	+13·3
South Western	227·3	240·0	+ 5·6	2,778·9	3,036·2	+ 9·3
Eastern	584·5	591·9	+ 1·3	7,174·4	7,936·6	+10·6
East Midlands	508·5	502·5	− 1·2	6,130·0	6,616·5	+ 7·9
Midlands*	654·6	652·1	− 0·4	7,793·3	8,576·1	+10·0
South Wales*	407·3	410·3	+ 0·7	4,611·5	4,941·7	+ 7·2
Merseyside and N. Wales* ...	405·8	414·9	+ 2·2	4,805·8	5,203·9	+ 8·3
Yorkshire*	677·3	652·4	− 3·7	7,993·3	8,576·5	+ 7·3
North Eastern*	400·6	397·3	− 0·8	4,616·0	5,001·0	+ 8·3
North Western*	682·2	683·7	+ 0·2	8,294·5	8,846·8	+ 6·7
Total all Area Boards	5,901·3	5,920·5	+ 0·3	71,098·7	77,428·3	+ 8·9
Direct Supplies by C.E.G.B. ...	190·4	246·2	+29·3	2,254·1	2,683·3	+19·0
Grand Total	6,091·7	6,166·7	+ 1·2	73,352·8	80,111·6	+ 9·2
Mainly Industrial Areas*	3,736·3	3,713·2	− 0·6	44,244·4	47,762·5	+ 8·0
Mainly Non-Industrial Areas ...	2,165·0	2,207·3	+ 2·0	26,854·3	29,365·8	+10·5

* Those in which industrial consumers took over 50 per cent of the total sales in the preceding financial year.

decision to end these sales after considerable losses on what had been an innovation. Mr. S. Wade, of Barnsley, while conceding that it was right that sales should be abandoned, considered that arrangements should be made to safeguard people who had purchased sets from the Board.

Mr. A. Haselhurst, chief commercial officer, stated that last year the Board's sales were down by one-third compared with 1956, the highest year. It was the Board's intention to carry out repair responsibilities under the guarantees, after which it would not continue a repair service.

As an outcome of an approach to the Board by the Council following a Sheffield complaint that a lounge had been assessed as two rooms because there was a projection rising from the floor to the ceiling, a new formula for assessing the modern "through-lounge" type of house was reported.

Council House Installations

Easington (Co. Durham) R.D.C. is to install socket-outlets in the living rooms of more than 4,600 of the older type Council houses. The cost will be about £12,000.

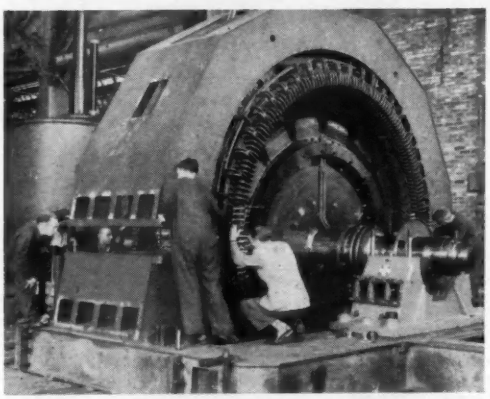
Hotel Electricity Costs

A meeting of the Southern Electricity Consultative Council was held at Basingstoke on 17th June, Group Captain J. C. M. Hay presiding. One of the matters considered was a complaint by a consumer against the effect of the commercial tariff in respect of his hotel. It was decided that this was a case where a somewhat limited use of the apparatus installed resulted in a high average price per kWh and that no recommendation could be made.

All-Electric Flats

Ayr Town Council agreed on 9th June that all flats in its future housing schemes will have electricity for lighting, heating and cooking. A coal fireplace will be built in living rooms only. The first such flats will be 48 four-storey flats to be built in King Street. In these flats, floor heating by electricity will be incorporated. The Council also decided to install electricity for cooking in its Whitletts scheme of 104 traditional houses.

The Scottish Special Housing Association has indicated that all future blocks of flats of four storeys and over which it builds will have electric floor warming installed.



The first of two Bruce Peebles 12 MW horizontal generators for the Inveran (Shin) power station of the North of Scotland Hydro-Electric Board

Amber House, Kampala, the new headquarters of the Uganda Electricity Board

OVERSEAS

New Uganda Board Headquarters

On 18th June, Amber House, the headquarters of the Uganda Electricity Board, was officially opened by the Governor of Uganda, Sir Frederick Crawford, K.C.M.G., O.B.E. The Electricity Board has 61 per cent of the total floor space, the remainder being taken by the Lint Marketing Board and the Uganda Coffee Industry Board. The Electricity Board at present occupies the top two floors and has sub-let a number of rooms on the floor below, most of which is allocated to the Board. Construction of the building started in July, 1955, and has taken roughly three years. Local materials have been used as far as possible. The external facing work is a feature of the building, consisting of pre-cast terrazzo blocks made from local quartzite which was crushed and reconstituted with cement. Several local timbers not normally used have been adopted. All door frames are of Munyama mahogany; the strip wall linings to the main staircase are of mumuli and nkoba has been used for panelling in the board room of the U.E.B. The traditional mvule timber has been used wherever wood block floors have been laid. The problem of parking cars is very difficult in Kampala and the winning design incorporated underground parking for about 100 vehicles.

Sierra Leone Plant Extensions

An item of interest in the Sierra Leone Broadcasting News Bulletin of 12th June was a report of the switching-on of a new set at the Electricity Department's power station at Falconbridge, Freetown, by the Governor, Sir Maurice Dorman. Although occupying the same floor space as the plant which it replaced, its output is approximately five times greater.

The Minister of Works and Housing, Kande Bureh, welcomed the Governor to the power station. Before operating the switch, Sir Maurice Dorman spoke of the rise in electrical demand, pointing out that ten years ago Freetown's peak load was only 955 kW and something like 4·5 million kWh was consumed annually. Now, he said, the peak load was 3,500 kW and 14·5 million kWh was consumed in a year, an increase of 350 per cent. His Excellency expressed thanks to the staff of the Department, to Mr. Bruno Gaston who is in charge and to Mr. Forde of the English Electric Co. who supervised the erection of the new set.

The new English Electric 1,800 h.p. 16 cylinder engine, which cost £35,000, is radiator cooled, this type of cooling being adopted because of the acute water shortage which occurred in Freetown last year.

Power from Petroleum Gas

According to a Barclays Bank message from Lagos, the Electricity Corporation of Nigeria plans to use petroleum gas from the Shell-B.P. oilfields in Eastern Nigeria to generate cheaper electrical power in the Port Harcourt area. The Corporation also proposes to extend electricity supplies to additional areas at an estimated cost of £400,000 as soon as plant and equipment are obtained and the necessary technical staff recruited.

NEW ELECTRICAL EQUIPMENT

Counters

An add and subtract counter has been introduced by COUNTING INSTRUMENTS, LTD., 5, Elstree Way, Boreham Wood, Hertfordshire. This counter is a self-contained unit with a five-figure presentation. The number wheels are actuated by two escapement type mechanisms operated from separate d.c. or a.c. supplies. The first escapement operates to add, at the same time releasing the second, and when subtracting this operation is reversed. Counting, positive or negative, is possible up to speeds of 17 per second and the design is such that damage cannot occur if both adding and subtracting pulses are supplied at the same time.

A high-speed electric counter with quick reset is also announced. The series 100 is a six-figure unit with low consumption, together with provision for instantaneous reset. The unit has an operating speed of at least 20 counts per second. The number wheels and associated pinions are moulded from a new low friction nylon and this assembly is actuated by a balanced escapement system set in jewelled bearings. This movement is operated by two small electro-magnets spaced around a common armature. Instantaneous reset is obtained by the deflection of a short lever and facilities for electrical reset will become available in the immediate future. The counter is available for either base (proud) or flush panel mounting with a.c. or d.c. supplies. It will shortly be offered for counting in dozens.

Temperature Scanner

An automatic potentiometric temperature scanner, type B.B.I., developed by FIELDEN ELECTRONICS, LTD., Wythenshawe, Manchester, uses one instrument to monitor a large number of temperature points. The temperature is indicated on a large dial approximately 2ft in diameter and around the periphery of this dial are the point numbers, e.g. 1-50. A motorised scanning switch enables the equipment to examine each point in turn, a clear "Perspex" pointer, tipped black, indicating the number of the point under examination. With this equipment it is possible to have a different set point for each of the 50 variables. The value of the set point is shown by the position of a red pointer and this can be adjusted by a small potentiometer under the indication bezel and in line with the temperature point number.

The actual value of the temperature is shown by the position of a green pointer. Thermocouples are used as the detecting elements and the output voltage of the thermocouple is compared with a stable d.c. voltage by means of a self-balancing servo-mechanism. All the thermocouple leads are terminated on a panel at the rear of the equipment and automatic cold junction compensation is incorporated. The equipment has three tolerance bands which can be adjusted to the required values.

The whole unit is made easily accessible and the electronic chassis are of the plug-in type and are on runners accessible through one of the front panels.

Cable Reel Jack

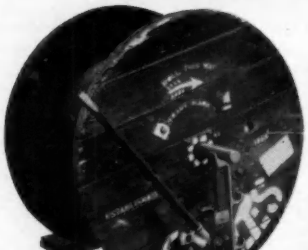
To the range of Duff-Norton ratchet lowering jacks made by the CONSOLIDATED PNEUMATIC TOOL CO., LTD., 232, Dawes Road, London, S.W.6, has been added a special model for handling cable drums. The new model follows the main features of the existing range but includes three specially shaped lugs as hooks for accommodating the drum spindles at heights of 8in, 16in and 24in from the ground.

Duff-Norton jacks use the familiar lever and fulcrum principle to lift and lower the load. The downward stroke of a lever, acting through a short pawl, raises a hardened steel square notched bar or rack by one lift. A long pawl slips into place to hold the load whilst the lever is being raised to engage a further notch. Controlled ratchet lowering is effected by reversing the mechanism. The advantages of this simple construction, apart from lower cost and maintenance, are faster operation and an easily handled unit. The cable drum unit, whilst of particular application to straight cable laying operations, is also suitable for the servicing of haulage ropes, hoists and winding gear. The cable reel unit weighs 66 lb and has a maximum working load of 5 tons per jack. The hooks will accommodate 2in diameter spindles.

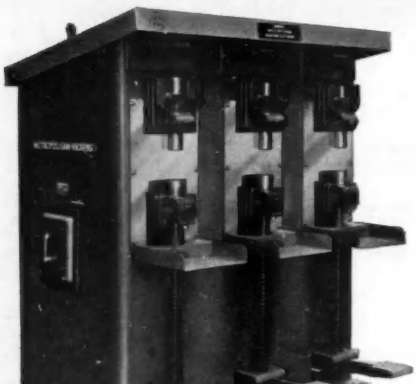
Rivet Heating Machines

New electric resistance rivet heating machines are announced by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, 17. These machines are ready for use instantly and the first rivet is ready within seconds of the machine being switched on, resulting in an appreciable saving in fuel costs and reduction in waiting time.

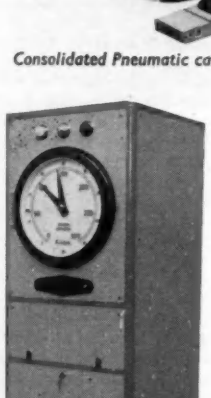
In the multi-head machines separate transformers are used so that each



Consolidated Pneumatic cable reel jack

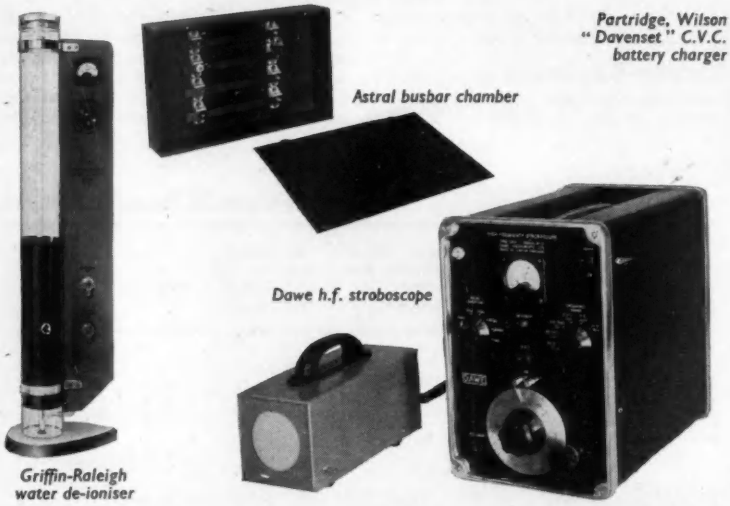


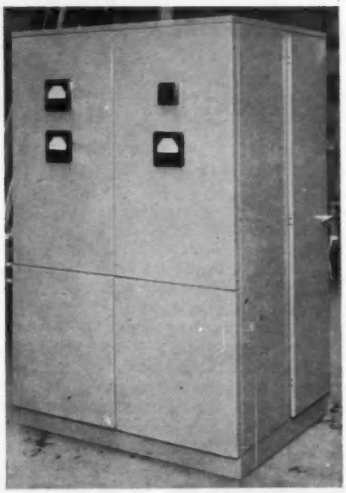
Metrovick three-head resistance rivet heater for pedal operation



Fielden temperature scanner type B.B.I.

Counting Instruments add and subtract counter (left) and high-speed counter




Partridge, Wilson "Davenset" C.V.C. battery charger

may be set on a different tapping if more than one size of rivet is required at a time, and to prevent the loading of one head affecting heating speeds on the others. A further advantage of this arrangement is that in the rare case of damage to a transformer, one head can be removed for repair and the others brought back into immediate production.

The transformers are enclosed in fabricated sheet steel cases, on the fronts of which are mounted the electrode holders. The upper electrode of each pair is fixed in an easily preset position, according to the average length of rivet being used, while the lower one is spring loaded, enabling it to be drawn away by depression of a pedal for loading and unloading. The machines may be used in semi-exposed positions as the standard range is of drip-proof construction.

Battery Charger

A new type of battery charger, designed for traction use, has just been announced by PARTRIDGE, WILSON & CO., LTD., Davenset Electrical Works, Evington Valley Road, Leicester. It employs magnetic control in the form of a closed loop system involving the use of a magnetic amplifier. Both the current and the output voltage are controlled automatically, hence it is named the "Davenset" C.V.C. (current voltage controlled) charger. It has no ancillary devices such as thermostats, timing relays or manually operated control switches and its main advantage lies in the fact that the shape of the current voltage output is square. In the normal charger the charging current reduces from the start of the charge at a fixed taper rate and the area bounded by the current voltage curve is triangular. The company claims that this enables a battery to be charged in about two-thirds of the time taken by a taper charger.

Its principal use is for parallel charging as any number of lead-acid batteries, providing they have the same number of cells, may be connected at one time even if they are in different states of discharge.

The chargers are designed for operation on 3-phase mains supplies of standard frequency and a 3-pole circuit-breaker, fitted with thermal magnetic overload trips, protects the equipment under short-circuit conditions. Mounted on the front panel of the cabinet are a moving coil ammeter and voltmeter. An additional ammeter may be supplied, together with a switch, to enable the charging current flowing into each battery to be measured. The output of the charger illustrated is 400 A, for 12 cells.

Busbar Chambers

The range of busbar chambers made by ASTRAL SWITCHGEAR, LTD., Alma Road, Enfield, Middlesex, has been completely redesigned and rationalised to 2ft, 3ft or 4ft case sizes and 200, 300 and 500 A capacity. The cases are constructed of heavy gauge steel sheet with flanges on each of the long sides to maintain rigidity. The cover, which has each short end flanged to give added support to the end walls of the chamber, is held in position by cleats on one long side which engage with the underside of the flange and by fixing screws in the other side.

The busbar assemblies comprise high conductivity copper bars each mounted on two porcelain insulators, complete with cable sweating sockets and colour phase identification discs. Specially designed insulator support flanges securely affixed to the bottom of the case facilitate assembly and allow for interchangeability of busbar assemblies to suit either three- or four-bar arrangements.

Water De-ioniser

The Griffin-Raleigh water de-ioniser supplied by GRIFFIN & GEORGE, LTD., Ealing Road, Alperton, Wembley, Middlesex, has been developed as a result of an invention in ion exchange technique employing three resins instead of two, by means of which it has become possible to regenerate small columns *in situ* and to produce extremely pure water at a cost of approximately 3d per 20 gallons when using London mains water. A built-in amplifier and a bridge circuit incorporating a conductivity cell enables water quality to be monitored and the circuit is independent of mains voltage and temperature fluctuations. The water de-ioniser is supplied ready for use in two sizes giving 16 and 64 gallons of very pure water per regeneration respectively. Using mains water, flow rates of 5 and 20 gallons per hour may be employed with an effluent conductivity of 0·2 micromho. Using as influent either single distilled or two-bed de-ionised water the effluent conductivity may approach 0·05 micromho.

High-Frequency Stroboscope

The normal stroboscopic flash tube is incapable of reaching flash rates for machines running at speeds over 100,000 r.p.m. owing to the relatively long de-ionisation time of the gas. The operation of such mechanisms was therefore usually studied by flashing only once in every five or six revolutions but this practice involves a loss of precision and sharpness.

The Type 1205 high-frequency stroboscope, made by DAWE INSTRUMENTS, LTD., 99, Uxbridge Road, London, W.5, avoids the difficulty of a long de-ionising time by using as the light source a 2in cathode-ray tube. Flash rates of up to 600,000 per minute (10 kc/s) are achieved by using the variable-frequency square wave from a built-in oscillator to trigger a pulse generator which in turn modulates the intensity of the electron beam of the cathode-ray tube. The pulse duration is variable from 3 μsec to 1 μsec in six steps. The flash rate at any time can be read off the calibrated scale encircling the control knob. This enables the unit to be used as an electronic tachometer.

Financial Section

STOCKS and SHARES

STOCK EXCHANGE markets drew considerable encouragement from the further reduction in Bank Rate to 5 per cent, coming hard on the heels of the Chancellor's proposal to increase the initial allowances on new plant and machinery. In the gilt-edged market, the move had been anticipated too confidently for the news to have much effect on prices. It evoked a stronger response from industrial shares, especially those coming within the range of Mr. Amory's evident concern with the rate of capital investment. Electrical and heavy engineering shares consequently showed up well in a further general improvement, which took the industrial share price indices up to the best level of the year.

Higher Prices

Helped by the success of the debenture issue, A.E.I. ordinary shares were well to the fore of the all-round advance of electrical engineering shares. They gained 2s 6d to 50s. G.E.C. rose equally well, to 33s 9d, while Reyrolle and Parsons were three or four shillings to the good. There were some substantial improvements in engineering shares associated with the main atomic power groups, notably in International Combustion, Simon-Carves and Head Wrightson. Among numerous other useful gains, mention may be made of those in Chloride Electrical, Lancashire Dynamo, Lucas, Crabtree Electric, and Electric Construction. Decca, Plessey, Ever Ready and Thorn Electrical were prominent. Cossor and Marryat & Scott moved up in anticipation of the annual results: both companies ended their financial year in March.

A.E.I. Debenture

Dealings in the £25 million issue of Associated Electrical Industries 6 per cent debenture Stock 1978–83 began at a premium of between 1½ and 2 points on the price of 98½ at which it was publicly offered. The operation was a great success, attracting subscriptions for more than five times the amount of stock available, with the result that most applicants were allotted amounts smaller than their requirements. There was some selling of allotments to secure the quick profit presented by the premium, but this was easily countered by new buying. The latest Bank Rate reduction has sharpened the investment appetite for stocks offering a 6 per cent return, with top-class security over an extended period of years, particularly when they can be bought free of the usual 2 per cent transfer stamp duty, as is the case at present with this A.E.I. issue.

Dubilier Condenser

There has been some increase of activity in the 1s shares of Dubilier Condenser, the price of which has moved up from 3s 6d to 4s 3d in the course of this month. The company's financial year ended in March, and if last year's precedent is followed the dividend declaration and preliminary

Price Changes in

Company or Board	Nom. Value	Middle price 23rd June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Gilt-edged Stocks						£ s p		
Brit. Elec. 1968/73	100	75½		3	3	3 19 6	75½	72
Brit. Elec. 1974/77	100	73		3	3	4 2 3	72½	68½
Brit. Elec. 1976/79	100	76½		3½	3½	4 11 6	76½	72
Brit. Elec. 1974/79	100	87	+½	4¼	4¼	4 17 9.	87	82¾
Overseas Electric Supply								
Calcutta Elec.	£1	16/6	+6d	6†	6 8†	8 5 0†	16/9	15/-
East African Power	£1	18/6		7	7½	8 2 3	19/3	17/6
Nigerian Elec.	£1	15/-		10	10	13 6 9	17/-	14/9
Perak Hydro-Elec.	£1	14/6		10	12½	17 4 9	15/6	14/-
Electrical Shares								
Aberdare Holdings	5/-	11/9		17½	17½	7 9 0	11/9	9/9
Aerialite	1/-	7/-		48	51½	7 7 0	7/-	5/1
Allen, W. H.	£1	37/-		10	11	5 19 0	37/-	32/9
Anglo-Portuguese Tel.	£1	25/3x.d.		8	9	7 2 6	27/3	19/9
Aron Elec. Ord.	£1	55/-	—2/6	15	15	5 9 0	57/6	53/-
Assoc. Elec. Ord.	£1	50/-	+2/6	15	15	6 0 0	51/3	46/6
Automatic Tel. & El.	£1	65/-		17	17	5 4 6	66/3	57/-
Babcock & Wilcox	£1	47/9		15	13‡	5 8 9	52/9	41/9
Bakelite	10/-	19/3		15	15	7 15 9	21/-	17/6
Baldwin, H. J.	2/-	2/9	—3d	20	20	14 10 9	3/9	2/9
Berry's Electric	5/-	7/-		—	10	7 2 9	7/6	5/9
British Aluminium	£1	43/9	+9d	12	12	5 9 6	47/-	37/-
Brit. Elec. Traction: Def. Ord. "A"	5/-	23/6	—6d	25	25	5 6 6	24/-	19/6
B.I. Callender's	£1	45/-	—6d	12½	12½	5 11 0	45/6	38/9
B.I. Callender's 6% Pref.	£1	19/-		6	6	6 6 3	20/3	19/-
British Tabulating	£1	47/6		9	10	4 4 3	47/6	38/6
British Thermostat	5/-	29/3x.d.	+1/-	25	30	5 2 6	29/3	19/9
British Vac. Cleaner	5/-	4/9		10	10	10 10 6	5/3	4/6
Brook Motors	10/-	37/6		25	25	6 13 3	37/6	33/3
Bulgin, A. F.	1/-	5/-		40	45	9 0 0	5/6	4/7
Bulpitts	5/-	7/6		—	12½‡	8 6 9	7/6	7/6
Burco Dean	5/-	9/-		20	22½	8 6 9*	9/6	7/9
Cable & Wireless: Ord.	5/-	10/6		10	10‡*	4 15 3	10/6	8/-
4% Loan	100	93¾x.d.		4	4	4 5 6	94½	89
Chloride El. Storage "A"	£1	58/9	+1/3	17½	17½	5 19 3	62/-	55/6
Clarke Chapman	£1	112/6		27½	27½	4 17 9	7½	5½
Cole, E. K.	5/-	17/9	+3d	17½	17½	4 18 6	18/-	15/6
Cossor, A. C.	5/-	4/9	+3d	Nil	2½	2 12 9	5/6	4/4
Crabtree	10/-	28/-	+1/6	20	20	7 2 9	28/-	24/4
Crompton Parkinson Ord.	5/-	10/6		16	16	5 1 6*	10/6	8/3
De La Rue	10/-	25/9	—6d	35	17½*	6 16 0	26/3	20/9
Decca "A"	4/-	26/3	+2/-	43¾	43¾	6 13 3	27/6	21/3
Desoutter	5/-	15/-	+6d	32½	18¾*	6 5 0	15/-	13/6
Dewhurst	2/-	8/-		16½	20	5 0 0	8/-	6/9
Dictograph Tel.	2/-	6/3		20	20*	6 8 0	6/3	4/7
Dubilier Condenser	1/-	4/3	+3d	30	30	4 14 3*	4/3	3/1
Duport	5/-	7/9		25	25	8 1 3*	9/4	7/9
E.M.I.	10/-	35/3	+9d	15	15	4 5 0	35/3	27/6
Electrical Components	5/-	7/6		25	12½*	8 6 9	8/-	7/-
Elec. Construction	£1	25/-	+1/3	8½	8½	6 16 0	25/-	21/-
Elliott-Automation	5/-	14/6	+3d	—	10‡	3 9 0	14/6	11/6
Enfield Cable Ord.	£1	15/-		Nil	2½	3 6 9	17/-	10/9
English Electric	£1	52/6		14	14	5 6 9	56/3	44/-
English Electric 3½% Pref.	£1	12/-		3½	3½	6 5 0	12/3	11/9
Ericsson Tel.	5/-	20/6	+3d	22†	12*†	2 18 6†	21/-	17/6
Ever Ready	5/-	19/3	+1/3	37½	20*	5 4 0	19/3	13/9
Falk Stadelmann	£1	38/9		17½	17½	9 0 9	38/9	35/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

profits statement can be expected in mid-July. It is the practice to make a single annual payment, and this year's will apply to capital increased by a 50 per cent scrip issue. Allowing for this, the 30 per cent dividends paid on the last two occasions would be equivalent to 20 per cent on the present capital of £323,000. On that basis the yield on the shares works out at 4¼ per cent. Last year's report mentioned a tendency towards lower selling prices, irrespective of higher costs, but given stable business conditions a satisfactory result for 1957–58 was anticipated.

Electrical Investments

Company or Board	Nom. Value	Middle price 23rd June	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1958 Highest	1958 Lowest
Electrical Shares—continued						£ s d		
G.E.C. Ord.	£1	33/9	+2/6	14	12½	7 8 3	38/9	29/3
G.E.C. 6½% Pref.	£1	20/3	+3d	6½	6½	6 8 6	21/3	20/3
General Cables	5/-	10/9	—1/-	30	24	—	11/9	10/9
Greenwood & Batley	£1	48/3	+1/-	17½	20	8 5 9	48/3	45/-
Hackbridge Holdings	5/-	12/9		30	20	7 16 9	13/3	7/6
Hackbridge & Hewittic	5/-	12/-		23	20	8 6 9	12/-	9/7
Head Wrightson	5/-	22/3	+6d	22½	17½*	3 18 9	22/3	16/9
Heatrae	2/-	5/6		15	20	7 5 6	5/6	4/-
Henley's	10/-	11/-		11½	11½	10 9 0	14/6	10/6
Holophane	5/-	13/6		30	37½	8 6 9*	13/9	12/6
Hoover	5/-	43/-	+6d	50	50	5 16 3	43/-	31/-
I.C.I.	£1	45/-	+6d	10	12	5 6 9	45/3	35/6
Intl. Combustion	5/-	26/6	+3/-	22½	25	4 14 3	26/6	19/3
Johnson & Phillips	£1	18/9	—6d	10	5	5 6 9	25/-	15/-
Lancashire Dynamo	£1	40/-	+1/3	11	11	5 10 0	40/-	28/6
Laurence, Scott	5/-	14/9	+6d	15	15	5 1 9	14/9	12/6
Lister, R. A.	£1	24/6		10	10	8 3 3	26/3	23/-
London Elec. Wire	£1	45/-	+6d	12½	12½	5 11 0	45/-	39/6
Lucas, J.	£1	35/-	+9d	7½	7½	4 5 9	35/-	27/9
Marconi Marine	£1	32/-		10	10	6 5 0	32/-	29/-
Marryat & Scott	2/-	13/9	+1/6	30	35	5 1 9	13/9	10/3
Mather & Platt	£1	60/-	+1/9	15	15	5 0 0	60/-	43/9
Metal Industries	£1	30/9	+9d	Nil	9	5 17 0	31/6	22/9
Midland Elec. Mfg.	£1	46/3	+1/3	12½	12½	5 8 0	48/3	44/-
Morphy-Richards	4/-	16/3	+9d	50	20*	4 18 6	16/9	14/6
Murex	£1	58/3	+3/3	20	20	6 17 3	58/3	53/3
Newman Ind.	2/-	2/3		10	10	8 17 9	2/9	2/3
Oldham & Son	1/-	2/6		17½	17½	7 0 0	2/7	2/3
Parnall (Yate)	5/-	13/9	+9d	12	12	4 7 3	14/3	5/9
Parsons, C. A.	£1	50/6	+4/-	8¾	7½*	2 19 6	53/6	43/-
Plessey	10/-	60/6	+2/6	30	30	4 19 3	60/6	55/-
Pye "A" Deferred	5/-	12/-		12½	12½	5 4 3	13/9	10/-
Reyrolle	£1	81/3	+3/9	17½	17½	4 6 3	84/6	73/6
Rheostatic	4/-	6/-		12½	12½	8 6 9	8/-	6/-
Richardsons Westgarth	10/-	13/6x.d.	+3d	16¾	8½*	6 3 6	15/-	13/-
Scottish Cables	4/-	14/3	+1/-	27½	27½	7 14 6	14/3	12/3
Simon-Carves	5/-	27/-	+1/6	20	25	4 12 6	27/9	22/6
Smith (England), S.	4/-	8/9		17½	20	4 11 6*	8/9	7/-
Southern Areas	£1	9/3	—9d	7½	Nil	Nil	13/9	9/3
Strand Elec.	5/-	4/9		15	15	15 15 9	6/3	4/9
Sturtevant	5/-	15/3	+6d	15†	15†	4 18 3†	18/-	14/9
Sun Elec.	£1	47/6		25	25	10 10 6	47/6	47/3
Switchgear & Cowans	5/-	11/6		25	22½	9 15 9	11/9	8/9
Taylor Tunnicliff	5/-	13/3		15	17½	6 12 0	13/9	11/9
T.C.C.	10/-	35/-		25	25	7 2 9	38/6	35/-
T.C. & M.	£1	23/-		8½	8½‡	7 7 9	27/-	20/-
Telephone Mfg.	5/-	4/9x.d.		10	10	10 10 6	5/3	4/6
Telephone Rentals	5/-	11/-	+3d	12½	12½	5 13 9	11/-	9/9
Thompson (John)	5/-	24/-	+6d	25	25	5 4 3	27/-	23/-
Thorn Elec. "A"	5/-	22/6	+2/6	15	17½	3 17 9	22/6	17/-
Thornycroft	£1	25/9		12½	12½	9 14 3	27/9	21/-
Tube Investments	£1	55/-		13¾	15	5 9 0	55/-	48/3
Vactric	5/-	14/3		25	25	8 15 6	15/6	14/3
Veritys	5/-	5/3		12½	12½	11 18 3	6/9	5/3
Walsall Conduits	4/-	14/3x.d.	+6d	20	22½	6 6 3	14/3	11/-
Ward & Goldstone	5/-	28/-		35	40	3 11 6*	28/6	23/6
Watford	2/-	7/6		25	25	6 13 3	7/6	5/-
Westinghouse	£1	40/-		18	10*	5 0 0	40/-	32/3
West, Allen	5/-	10/9	+3d	15	12½*	5 16 3	12/-	9/3
Wolf Electric	5/-	6/9		20	10*	7 8 3	9/-	6/9

Company News

There was a sharp rise, from 7s 6d to 8s 9d in the 5s shares of Ultra Electric in response to the dividend and profits statement in respect of the year ended last March. The "A" (non-voting) shares were quoted at 8s. A year ago the dividend was halved, to 7½ per cent, as the result of a setback in earnings. For the latest period, the group profit comes out at almost double the 1956–57 figure, and the dividend is to be restored to 15 per cent. After tax of £149,000, there is a net profit of £114,000, of which the dividend distribution absorbs £63,000. The yield on the shares rises to over 8½ per cent. General Cable 5s shares were lowered to 10s 9d after the announcement of the company's decision to pay no interim dividend for the current year, which ends in September, and to defer consideration of a payment until the full results are available.

L.E.W. Outlook

Reviewing prospects at last month's annual meeting of London Electric Wire Co. & Smiths, Mr. E. L. Wildy instanced the American trade recession and the credit squeeze at home as factors making prophecy particularly difficult, but was able to report that demand for the products this year, and the group's trading profits, had been at least as good as in the opening months of 1957. He hoped, too, that this time there would be no recurrence of heavy stock losses: in the last year's accounts provision was made for depreciation to the extent of over £300,000 on working stock. A reserve of £193,000 had been made against this, but a sum of £112,000 remained to be charged against profits. Allowing for this, the group profit, subject to tax, came out £240,000 lower than before at £776,000. The dividend of 12½ per cent is covered more than twice by the net distributable surplus, and produces a yield of rather more than 5½ per cent on the £1 shares at 45s.

Dividends Declared

Simms Motor & Electronics are raising their dividend by the equivalent of about a point, to 12½ per cent, for the past year, during which capital was increased by a two-for-one scrip issue and also by acquisitions, including the business of the Motor & Electronics Corporation. The 5s shares improved to 9s 9d, at which price the yield is close on 6½ per cent. Greenwood & Batley £1 shares were raised officially by 1s to 48s 3d (the market quotation rose to 50s) after the announcement of higher profits and an increase in the dividend from 17½ to 20 per cent. Lower earnings for 1957–8 are reported by Vactric and Aron Electricity Meter, but the dividends are being maintained at the previous rates of 25 and 15 per cent respectively.

REPORTS and DIVIDENDS

Scottish Cables, Ltd.—The main figures in the accounts for the year ended 31st March last were published in our issue of 6th June.

In his statement which has been circulated with the report and accounts, Mr. W. Fraser (chairman) says that the new factory, equipped for the production of a wide range of plastic insulated and sheathed cables, is now in full production. They are, however, already requiring increased capacity and have put in hand the first stage of an extension. The new laboratories and technical offices are now in an advanced stage of construction and it is expected that they will be in full operation before the end of the year. Against a general background of increasing competition and a reduced demand in the home market brought about as a result of the Government policy of credit restriction, their factories have operated throughout the year at a high level of activity, and the output again created a new record. A substantial proportion of their business emanates from the Electricity Boards, National Coal Board, British Transport Commission, G.P.O. and Government Departments, and they have continued to obtain valuable contracts from each of these sources. They have also extended the volume of business with wholesalers, electrical contractors and industrial users. The associated company in South Africa experienced difficult trading conditions in the year ended 30th June, 1957, and in spite of a record output the extreme competition resulted in a lowering of the profit and a reduction of dividend from 14 per cent to 12½ per cent.

Lightfoot Refrigeration Co., Ltd.—Mr. K. Lightfoot (chairman) presided at the annual meeting held on 17th June. In his review of the year, which had been previously circulated, the chairman said that increased sales of their refrigerating machinery and the manufacture of a greater proportion of this in their own works together resulted in an increase in profit earned by the engineering business of the parent company. The cold storage side of the business also had a good year and showed a substantially greater profit than in the previous year. The value of completed installations of refrigerating machinery invoiced during 1957 reached a record figure, showing an increase of 22 per cent as compared with the preceding year. Orders received during 1957 enabled them to commence the current year with a 15 per cent greater value of unexecuted orders on hand than was the case a year ago. They had been successful in negotiating a long lease for additional factory space adjoining the existing premises which would increase their productive area by approximately 50 per cent. The volume of orders received for refrigerating plant during the first four months of the current year had continued at a satisfactory level.

Heatrae, Ltd.—The accounts for the year ended 28th February last show a trading profit of £80,203, as compared with £46,194 for 1956-57, and after meeting all charges, including £29,850 for taxation, the net profit is £30,377 (against £14,161). As reported in our issue of 16th May, it is proposed to pay an ordinary dividend for the year of 20 per cent (against 15 per cent), and to carry forward £65,979 (against £42,214 brought in).

In his statement, which has been circulated with the accounts, Mr. C. H. Smith (chairman and managing director) says that the turnover for the year is satisfactory and shows a substantial increase on that for the previous year. The rise is only partly due to increase in prices and is mostly due to increased output of products. Further additions to buildings are now in progress. During the year under review the company has purchased more freehold properties on the Pitt Street (Norwich) frontage, which, in due course, will give facilities for extensions to the factory premises.

Ultra Electric (Holdings), Ltd.—The group profit for the year ended 31st March last amounted to £262,996, as compared with £135,267 for 1956-57, and after providing £148,805 for taxation, the net balance is £114,191 (against £64,939). It is proposed to pay a dividend for the year of 15 per cent (against 7½ per cent).

Marco Refrigerators, Ltd., has declared an interim dividend on the ordinary stock of 2½ per cent (unchanged). The company states that turnover continues to show a steady rate of increase and provided no serious setback is experienced, the board anticipates that the financial results for the year will compare favourably with those of 1957.

Associated Electrical Industries, Ltd.—The application list for the issue of £25 million 6 per cent debenture stock 1978-83 at £98½ per cent was closed at 10.5 a.m. on 17th June, the issue having been heavily over-subscribed.

Ever Ready Co. (Great Britain), Ltd.—The annual meeting will be held on 9th July. In his circulated statement, Mr. E. N. Rowbotham (chairman) says that earnings during the year under review constituted yet another record. Sales on the home market were maintained, and although certain export markets were adversely affected by political and economic considerations, particularly in the Middle East, their figures were maintained. These setbacks were only temporary and export sales are currently well above those for last year. The improved earnings were due to continued increased efficiency of production methods, and also to reductions in the prices of some of the major raw material, although the latter was offset in some measure by a substantial increase in the price of manganese. In view, however, of the overall savings in cost, reductions have been made in the retail prices of most of their radio and transistor "Power Pack" batteries in the home market. Their subsidiary companies, both at home and abroad, have all experienced satisfactory trading and profits have increased.

Referring to developments in the dry battery field, the chairman says that the use of equipment employing semi-conductors is developing steadily and they have recently introduced a completely transistorised radio set which has been well received. This set is powered by one of their range of "Power Pack" batteries specially developed for use with transistors. The current year's trading has started well, sales to date being in excess of those for the corresponding period last year.

The General Cable Manufacturing Co., Ltd., has decided not to pay an interim ordinary dividend. The directors state that the question of a dividend will be considered in the light of results shown for the year ending 30th September next. For the previous year the total dividend was 24 per cent, of which 12 per cent was paid as an interim dividend.

Vactric, Ltd.—Group net profits for the year ended 29th March last amounted to £159,785 against £249,632 for 1956-57. The final ordinary dividend of 15 per cent maintains the total distribution at 25 per cent.

Aron Electricity Meter, Ltd.—The net profit for the year to 31st March last was £38,486 (against £63,193). The dividend for the year is 15 per cent (same).

The Hawker Siddeley Group, Ltd., has declared an interim dividend of 3 per cent (unchanged).

International Combustion Africa, Ltd., is paying an interim dividend of 20 per cent (against 15 per cent).

Bankruptcies

A. Sheridan, lately trading in partnership with another as S. M. Disposals, of 223, Richmond Road, Hackney, London, E.8, radio and electrical contractor.—Application for discharge to be heard on 18th July at Bankruptcy Buildings, Carey Street, London, W.C.2.

G. W. Altass, 1, Bruce Avenue, Shepperton, Middx., electrical engineer and general contractor.—Application to review order of discharge to be heard on 11th July at the Guildhall, Kingston-on-Thames.

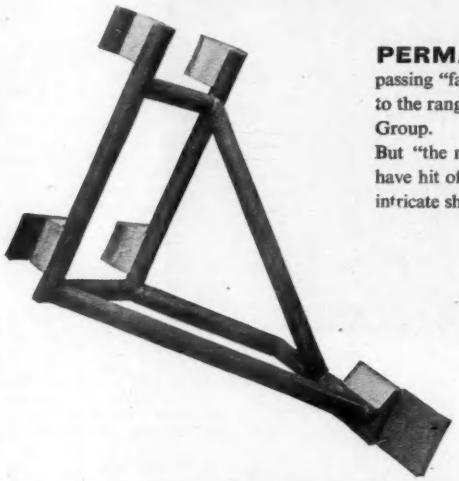
J. F. Lighton and **A. R. White,** trading as Heathers of 737, Sidcup Road, New Eltham, S.E.9, and 119, Old Dover Road, Blackheath, S.E.3, as cycle, radio and electrical dealers.—Last day for receiving proofs for dividend 4th July. Trustee, Mr. N. W. Osborne, Bank Chambers, 1, John Street, Bedford Row, London, W.C.1.

Liquidation

Empire Electric Co. (Hounslow), Ltd., electrical equipment specialists, 189, Hanworth Road, Hounslow, Middx.—Last day for receiving proofs for dividend 4th July. Liquidator, Mr. N. W. Osborne, Bank Chambers, 1, John Street, Bedford Row, London, W.C.1.

'The glass of fashion and the mould of form'—HAMLET ACT III Sc.I.

PERMAGLASS



PERMAGLASS—glass fibre reinforced plastic—is no mere passing "fashion". It is a permanent and exceedingly valuable addition to the range of reinforced plastics for industry produced by the Permali Group.

But "the mould of form"—only William Shakespeare himself could have hit off Permaglass with such precision! For it can be moulded to intricate shapes and machined and punched to close tolerances.

PERMAGLASS is strong, light, hard, durable, and a good electrical insulator. It is available as sheets, tubes and in moulded form, with Polyester, Epoxide, Melamine or Phenolic resin bases.

What is PERMAGLASS used for?—from drilling jigs to fans, from covers and cases to electrical insulating components, its applications are infinite. It is almost certain that Permaglass can serve you economically and efficiently in some form—moulded or otherwise.

Will you write to us for technical data about it?

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Permaglass Division, Gloucester

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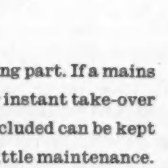
Ready for the call

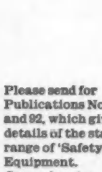
Tudor ' Safetylyte ' is always ready to play the leading part. If a mains interruption occurs, it springs automatically into action for instant take-over at split-second notice. The Tudor storage battery included can be kept fully charged for many years at negligible cost and needs little maintenance. Tudor 'Safetylyte' Emergency Lighting Equipment is available in compliance with all Home Office and County Council regulations. It offers complete emergency lighting protection in every type of public building both large and small.

Please send for Publications Nos. 90, 91 and 92, which give full details of the standard range of 'Safetylyte' Equipment. *Comprehensive specifications for special emergency lighting installations prepared without obligation.*



A *Double-tier stand holding a typical battery of 14 Tudor sealed-type cells as used with 'Safetylyte' emergency lighting equipment.*

B *'Safetylyte' Major charging and control cubicle.*



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TUDOR SAFETYLYTE EMERGENCY LIGHTING EQUIPMENT

THE TUDOR ACCUMULATOR COMPANY LTD., 137 VICTORIA STREET, LONDON SW1. Tel : TATe Gallery 0307 Works : DUKINFIELD, CHESHIRE. Tel : Ashton-under-Lyne 1651

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1953

9898 and 10086. United Kingdom Atomic Energy Authority.—Nuclear reactors. 12th July, 1954. (796991/2.)

20486. Rado, L.—Radio frequency heating electrodes. 5th July, 1954. (797202.)

27169. General Electric Co., Ltd., Brown, C. S., and Kell, R. C.—Methods of growing quartz crystals. 29th September, 1954. (797203.)

27178. Electric & Musical Industries, Ltd. —Electrically operated two-state devices especially for storing binary digital data. 22nd September, 1954. (796993.) 27179. Interpolating or extrapolating devices especially for the control of automatic machine tools. 22nd September, 1954. (796994.) 34219. Apparatus for converting digital code signals to analogue signals. 26th November, 1954. (Addition to 731650.) (796995.)

1954

9192. Parkinson & Cowan, Ltd.—Coin-freed mechanism for prepayment gas and electricity meters. 22nd March, 1955. (797072.)

16819. Harmer, H. M.—Current and voltage regulating arrangements. 8th September, 1955. (797204.)

24847. Clevite Corporation.—Method of producing small semi-conductor single crystals. 26th August, 1954. (797205.)

28393. National Research Development Corporation.—Electrical computing engines. 15th September, 1955. (797000.)

34203. Egyesült Izzölampa es Villa-Mossagi R.T.—Manufacture of electric incandescent lamps. 25th November, 1954. (797207.)

36466. Pye, Ltd.—Circuit arrangements for controlling the frequency of an oscillator. 16th December, 1955. (796953.)

1955

3705. M-O Valve Co., Ltd., Cook, K. G., and Isaacs, G. G.—Gas-filled electric discharge devices. 8th May, 1956. (Cognate application 4798, 15th February, 1956.) (797047.)

3925. Postmaster General. — Electric signal transmission systems. 6th February, 1956. (797077.)

5109. Opperman, Ltd., S. E.—Amplifying devices for telephone hand-sets. 23rd July, 1956. (797048.)

5682. Igranic Electric Co., Ltd.—Electric controllers. 25th February, 1955. (797079.)

7531. Igranic Electric Co., Ltd.—Electric switch cases. 15th March, 1955. (797049.)

11551. Pye, Ltd. — Current feedback circuit for push-pull amplifiers. 5th April, 1956. (797082.)

11799. National Research Development Corporation.—Electrical instrument movements of moving magnet type. 18th April, 1956. (797083.)

12934. Pye, Ltd.—Automatic frequency control system for frequency modulation receivers. 26th April, 1956. (797084.)

13125. Teledictor, Ltd.—Electronic apparatus for detecting the presence of metal. 3rd April, 1956. (797085.)

13591. Kily, T. A.—Low temperature self-controlling waterproof electric heating elements. 3rd May, 1956. (797086.)

16480. General Electric Co., Ltd.—Tungsten filament lamps. 7th September, 1956. (797010.)

19695. Burroughs Corporation.—Diode amplifiers. 7th July, 1955. (797090.)

23615. General Railway Signal Co.—Code communication systems. 16th August, 1955. (797140.)

24828. Esso Research & Engineering Co. —Electrolytic production of metal alkyls. 25th June, 1956. (797093.)

25314. Schmid, W. K.—Electromagnetic variable-speed drives. 2nd September, 1955. (Addition to 748255.) (796998.)

25566. British Insulated Callender's Cables, Ltd.—Electrical connectors. 5th September, 1956. (Addition to 793876.) (797197.)

27516. Associated Electrical Industries, Ltd.—Vacuum pumping systems. 7th December, 1956. (796928.)

28411. Metropolitan-Vickers Electrical Co., Ltd.—Electric heating devices. 5th October, 1956. (797016.)

28701. Siemens & Halske Akt.-Ges.—Magnetically-operated control or signalling apparatus of the control magnet and receiver type. 7th October, 1955. (797223.)

29324. English Electric Co., Ltd.—Control systems for dynamo-electric machines. 9th October, 1956. (796930.)

32193. Sperry Rand Corporation.—Microwave apparatus. 10th November, 1955. (797142.)

32549. Svenska Relafabriken-Aktiebolaget. —Electrical communication systems. 14th November, 1955. (797055.)

34042. Hofmann, E.—Electrical connectors. 28th November, 1955. (796963.)

34606. Siemens & Halske Akt.-Ges.—Relay controlling apparatus in railway safety systems for signalling between a vehicle and the track which carries the vehicle. 2nd December, 1955. (797056.)

34869. General Electric Co., Ltd., and Shepherd, S. A.—Electrical socket connectors. 26th November, 1956. (796964.)

35627. Technical Ceramics, Ltd.—Apparatus for frequency spectrum analysis. 12th December, 1955. (797057.)

35756. Pye, Ltd.—Synchronising pulse separator circuits particularly for television. 13th December, 1956. (Addition to 755108.) (797108.)

1956

83. Parsons & Co., Ltd., C. A.—Nuclear reactors. 7th December, 1956. (796966.)

387. Standard Telephones & Cables, Ltd.—Variable electric resistors. 4th January, 1957. (796931.)

1420. General Dynamics Corporation.—Electrostatic printing. 16th January, 1956. (797024.)

4412. Compagnie Générale de Télégraphie sans Fil.—Automatic gain control systems for television receivers. 13th February, 1956. (797114.)

5186. General Dynamics Corporation.—Electrostatic printing. 20th February, 1956. (797027.)

6012. Veb Grubenlampenwerke.—Gas-escape devices for alkaline electric accumulators. 27th February, 1956. (797255.)

6078. Naimer, H.—Control of electrically driven mechanism. 27th February, 1956. (797116.)

6212. Sumo Pumps, Ltd., and Hallett, L. B. H.—Cooling of electric motors. 17th December, 1956. (796970.)

7519. Compagnie Française Thomson-Houston.—Arrangements for cooling electronic tubes. 9th March, 1956. (Addition to 706209.) (797117.)

9158. General Electric Co.—Radiation-sensitive cells. 23rd March, 1956. (796974.)

10856. Standard Telephones & Cables, Ltd.—Radio diversity receiving system. 10th April, 1956. (797123.)

12993. Soc. Triflux.—Supply system for feeding electrical discharge lamps with high-frequency current. 27th April, 1956. (796976.)

16070. Norddeutsche Seekabelwerke Akt.-Ges.—Electric conductor enclosed by a heat-resistant and moisture-proof insulation. 24th May, 1956. (797261.)

17826. General Electric Co.—Polyphase electric generators. 8th June, 1956. (796940.)

18262. Philips Electrical Industries, Ltd. —Ferrite material for use at microwave frequencies and methods of manufacturing such material. 13th June, 1956. (797168.)

19153. Gudjohnsen, H., and Gudjohnsen, J.—Electrified trawls. 20th June, 1956. (796941.)

19420. Gunnebo Bruks Aktiebolag.—Magnetic electric switch. 22nd June, 1956. (797169.)

24251. Baldwin, H. T., and Brooke, W.—Earth leakage protection systems for electrical motors, cables and other purposes. 8th August, 1956. (797036.)

24383. Hoover, Ltd.—Suction cleaners. 9th August, 1956. (797177.)

25959. Standard Telephones & Cables, Ltd.—Carrier for oxide cathodes. 24th August, 1956. (797095.)

27461. Philips Electrical Industries, Ltd. —Enclosure devices for radioactive sources of radiation. 7th September, 1956. (797264.)

37200. Innocenti Soc. Generale per l'Industria Metallurgica e Meccanica.—Battery-charge regulator. 5th December, 1956. (797064.)

37360. G-V. Controls, Inc.—Temperature-responsive electrical switches of thermostats. 6th December, 1956. (797269.)

38530. Felten & Guilleaume Carlswerk Akt.-Ges.—Method for determining the location of leaks in tubes subjected to pressure, in particular in high tension electric cables, by means of the Halogen leaktracer. 18th December, 1956. (797187.)

39358. Union Carbide Corporation, formerly Union Carbide & Carbon Corporation. —Electric arc welding of steel. 27th December, 1956. (796949.)

39640. Senior Economisers, Ltd.—Boiler economisers. 31st December, 1956. (796950.)

1957

3576. General Electric Co.—Neutronic reactor fuels. 1st February, 1957. (796989.)

10920. Beswick, K. E.—Electric fuses. 3rd April, 1957. (Addition to 648031.) (797068.)

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 30th June

BIRMINGHAM.—Edgbaston Golf Club. Midland Area Final, Electrical Industries National Golf Championship.

Tuesday, 1st July, to Friday, 4th July

BRISTOL.—Royal Show.

Thursday, 3rd July

LONDON.—Dorchester Hotel, Park Lane, W. Plastics Institute. Annual luncheon.

Friday, 4th July, to Saturday, 19th July

MANCHESTER.—Belle Vue. British Fair of Industry and Commerce.

Saturday, 5th July, to Wednesday, 9th July

DUBLIN.—Institution of Heating and Ventilating Engineers. Summer Conference.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Barking.—Corporation. 8th July. Street lighting equipment. (See this issue.)

Birmingham.—Birmingham (Dudley Road) Group of Hospitals Committee. Applications are invited from electrical firms for inclusion in the approved list for maintenance work at hospitals. Secretary, Hospital Management Committee, Dudley Road Hospital, Birmingham, 18.

Burma.—Burma Purchase Board, Rangoon. 3rd July. T.r.s. cable. (E.S.B. 15513/58. Ten/33014.)*

Bury.—Corporation. 19th July. Street lighting equipment. (See this issue.)

Dorset.—County Council. 14th July. Supply of electric lamps. (See this issue.)

Farnborough.—U.D.C. 15th July. Centrifugal sewage pump, motors, starters and control panels, for Water Lane pumping station. Engineer and surveyor, Municipal Offices, Alexandra Road, Farnborough, Hants.

Formosa.—Central Trust of China, Taipei. 15th July. Switchgear, transformers and auxiliary switchboards. (E.S.B. 15035/58. I.C.A. Ten/32966.)* 28th July. Transformers. (E.S.B. 15031/58.I.C.A. Ten/32962.)*

Heywood.—Corporation. 6th August. Electrical installations in 108 dwellings. (See this issue.)

India.—Mysore Government Stores Purchase Committee, Bangalore. 15th July. 11 kV power cables and accessories for substations. (E.S.B. 15242/58. Ten/32991.)*

Bombay Government Central Stores Purchase Organisation. 9th September. 220 kV oil filled cable with accessories. (E.S.B. 15588/58. Ten/33060.)*

Iran.—Iranian Army Armament Department, Teheran. 2nd August. Four electrically driven acid pumps. (E.S.B. 14985/58. Ten/32972.)*

Northern Ireland.—Down County Education Committee. Electrical installation in Redburn (New) Primary School, Holywood, Co. Down. J. McCandless, consulting engineer, 6, Murray Street, Belfast.

28th July. Electrical installation in new voluntary school for girls, Enniskillen. McAuslan & Abbott, consulting engineers, 16, Bedford Street, Belfast.

Philippines.—National Power Corporation, Manila. 16th July. Substation equipment for Central Luzon electrification project. (E.S.B. 15595/58. Ten/33061.)*

Rhodesia and Nyasaland.—Umtali Electricity Department. 2nd July. Five electric cooking tables. (E.S.B. 15275/58. Ten/32984.)*

South Rhodesia Electricity Supply Commission, Salisbury. 10th July. V.h.f. radio telephone equipment. (E.S.B. 15296/58. Ten/33054.)*

Salisbury City Council. 22nd July. Metering equipment for Hunyanipoort augmentation scheme and Warren pumping station. (E.S.B. 15278/58. Ten/33039.)*

St. Albans.—City Council. 14th July. Sodium lanterns. (See this issue.)

South Africa.—Pretoria City Council. 9th September. Two 55,000 lb/hr boiler units and two 60,000 kW turbo-alternators. (E.S.B. 19859/57. Ten/32982.)*

Union Tender and Supplies Board, Pretoria. 10th July. Electric etchers, earth resistance tester, battery chargers, armature growlers, and oil-immersed switch. (E.S.B. 15402/58. Ten/33004.)* 17th July. Audio amplifiers, loudspeakers and cabinets. (E.S.B. 1539/58. Ten/33005.)*

Stores Department, South African Railways, Johannesburg. 16th July. Three 500 kVA stepdown transformers. (E.S.B. 15403/58. Ten/33009.)* Lightning arrestors. (E.S.B. 15404/58. Ten/33010.)*

South West Africa.—South West Africa Tender Board. 4th July. Five electric refrigerator units for hospitals and hostels. (E.S.B. 15565/58. Ten/33069.)* Echo sounder and radio broadcasting and receiving set. (E.S.B. 15563/58. Ten/33076.)*

West Lancashire. — R.D.C. 14th July. Trunk road lighting equipment. (See this issue.)

Washington (Durham). — U.D.C. 4th August. Provision of 70 electric street lighting units. Council surveyor.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

London.—City Streets Committee. Recommended. Fluorescent lanterns (£4,252); and street lighting columns (£858) for Route 11 between Moorgate and Aldersgate Street.—G.E.C.

Oxford.—Highways, Sewers and Lighting Committee. Recommended. Street lighting in connection with the eastern by-pass (£14,417).—Southern Electricity Board.

Rayleigh (Essex).—U.D.C. Street lighting in London Road and in Hockley Road (£4,478).—Loughborough Construction Co.

Southport.—Lighting Committee. Equipment for street lighting conversion scheme: 691 "S.S. Fifty-One" lanterns and equipment (£6,661).—A.E.I. Lamp & Lighting Co. 300 concrete columns (£3,075).—Stanton Ironworks Co. Erection of columns (£1,380).—W. J. Furse & Co. (Manchester).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Accrington. — Showrooms and offices, Broadway; S. H. Chippindale & Co., Howard House, Bank Street, Bradford.

Alcester.—Houses (46) for R.D.C.; F. B. Andrews & Son, architects, 96, Colmore Row, Birmingham.

Barking.—Erection of South East Essex Technical School (£200,000); H. Conolly, county architect, County Hall, Chelmsford.

Birmingham.—Dental hospital; E. A. Norton, United Birmingham Hospitals, Great Charles Street, 3.

Castle Donington.—Houses (57), Windmill Fields estate, for employees of the C.E.G.B.; surveyor, 4, Clapgun Street, Castle Donington, Leics.

Cumberland.—Clinic and occupation centre at Wigton (£15,800); Border Engineering Contractors, Ltd., builders, Queen Street, Whitehaven.

Dundee.—Ward block, Royal Victoria Hospital, for the Eastern Regional Hospital Board; engineer, 430, Blackness Road, Dundee.

East Ham.—Flats (55), Sandringham Road and Church Road; borough engineer.

Edinburgh.—Two blocks of luxury flats, Barnton (£180,000); Boland & Co., builders, Northumberland Street, Edinburgh, 3.

Essex.—Community centres and libraries at Harlow and Basildon; H. Conolly, county architect, County Hall, Chelmsford.

Farnworth.—St. Gregory's Secondary Modern School, Harrowby Street; Greenhalgh & Williams, architects, 15, Mawdsley Street, Bolton.

Grantham.—Old people's home, Gorse Road (£42,000); county architect, Sleaford, Lincs.

Haltwhistle.—Rebuilding stores for Haltwhistle, Greenhead and District Co-operative Society (£40,000); C.W.S. Building Department, contractors, Benton Road, Newcastle-on-Tyne.

Ipswich.—Infants' school, Sprites Lane; Geo. A. Kenney & Sons, Ltd., builders, Burrell Road.

Kew.—Seven-storey office block, "Q" Theatre site; Tersons, Ltd., builders, 4, Dollis Park, London, N.3.

Knaresborough.—Branch and regional headquarters for county library, Market site; West Riding county architect, Westfield Road, Wakefield.

London.—Fourteen-storey block of offices, Chapel Street, Marylebone; Geo. Wimpey & Co., Ltd., builders, 23, Hammersmith Grove, W.6.

Flats (83), Bexley Road, Eltham, Woolwich; borough engineer.

Lowestoft.—Three-storey building for health clinic and education departments; E. J. Symcox, East Suffolk county architect, County Hall, Ipswich.

Northumberland.—Housing developments on 52 acres of land at Wideopen; John T. Bell & Sons, builders, Market Street, Newcastle-on-Tyne.

Oxford.—Retail store, Cornmarket Street; Marks & Spencer, Ltd., 82, Baker Street, London, W.1.

Peterborough.—School extensions and improvements (£37,200); King's School, Park Road.

Portsmouth.—Houses (110), Furze Lane estate, Milton; J. Parkin, city engineer, 1, Clarence Parade, Southsea.

Rochford. — Twin operating theatres, General Hospital; N.E. Metropolitan Regional Hospital Board, 3/4, Queen Anne Street, London, W.1.

Sheffield.—Granville College of Further Education (£330,000); Higgs & Hill, Ltd., builders, 33, St. Pauls Street, Leeds.

Sunbury-on-Thames. — Process development laboratories for British Petroleum Co., Ltd.; Higgs & Hill, Ltd., builders, Crown Works, South Lambeth Road, London, S.W.8.

Sunderland.—Houses (86), South Johnson Street; L. W. Evans, Ltd., contractors, 18, Norfolk Street.

Student teachers' hostel, Mowbray Road (£22,462); Wear Contractors, Ltd., builders, Olive Street, South Shields.

Rebuilding offices, John Street, for the Royal Assurance Co., Ltd.; Newrick & Blackbell, architects, 58, John Street, Sunderland.

Tunbridge Wells.—Dwellings (50), Broadwater area; Country Town Properties, Ltd., 32, Broadwater Down.

Tynemouth.—Old people's flats (34), Marden and West Chirton; borough engineer, 16, Northumberland Square, North Shields.

Whitby.—Additions to Whitby Grammar School for North Riding E.C. (£42,000); Plaxton, Ltd., builders, Seamer Road, Scarborough.

Whitehaven.—R.C. infants' school; Gordon Durham & Co., Ltd., builders, Station Road, Workington.

Whitley Bay.—Houses (42), Millfield estate; L. Netts, architect, 36, Jesmond Road, Newcastle-on-Tyne.

York.—Dwellings (98), Low Field estate; Sorrell (York), Ltd., builders, Hildreth House, Main Street.

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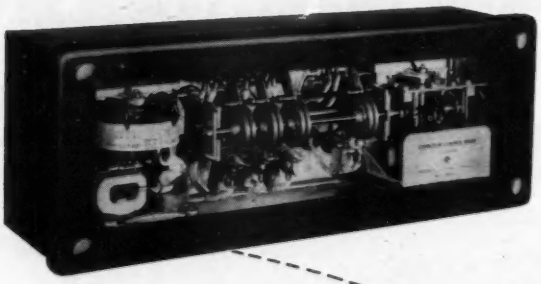

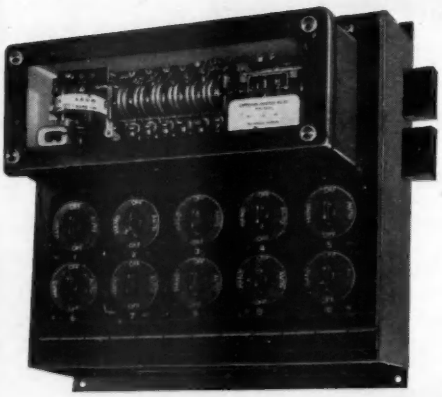

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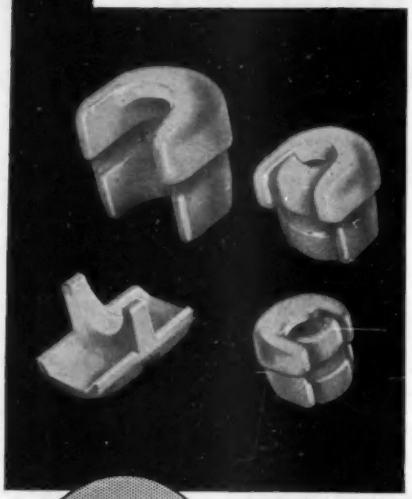

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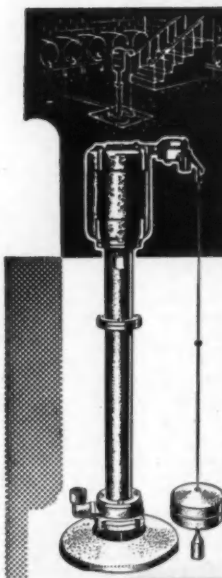

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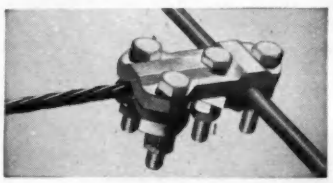

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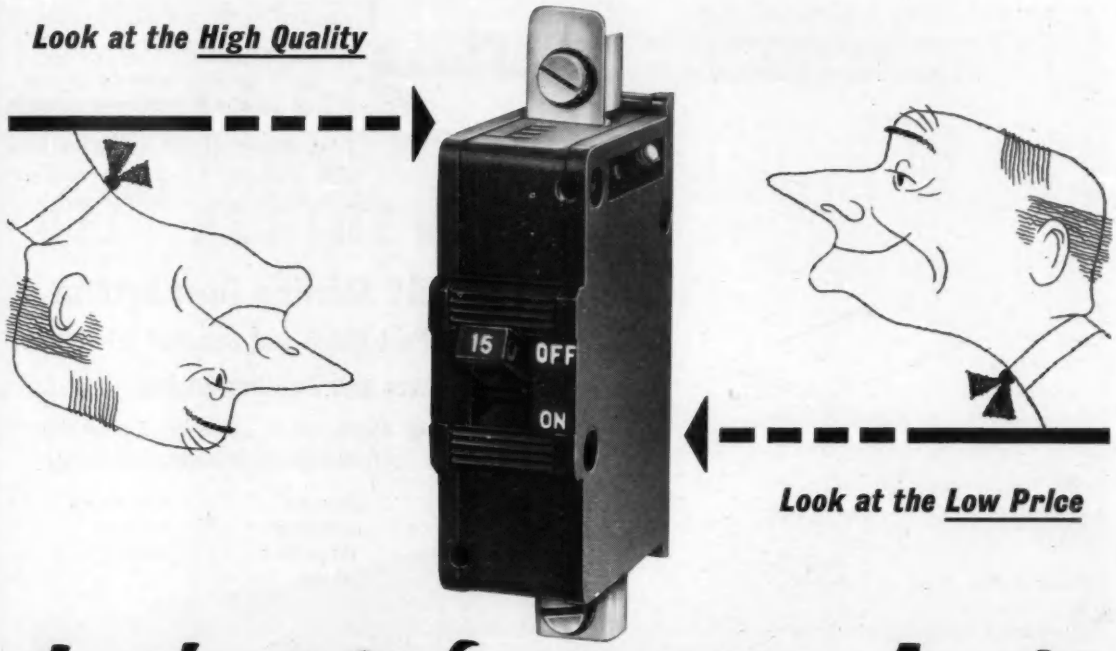

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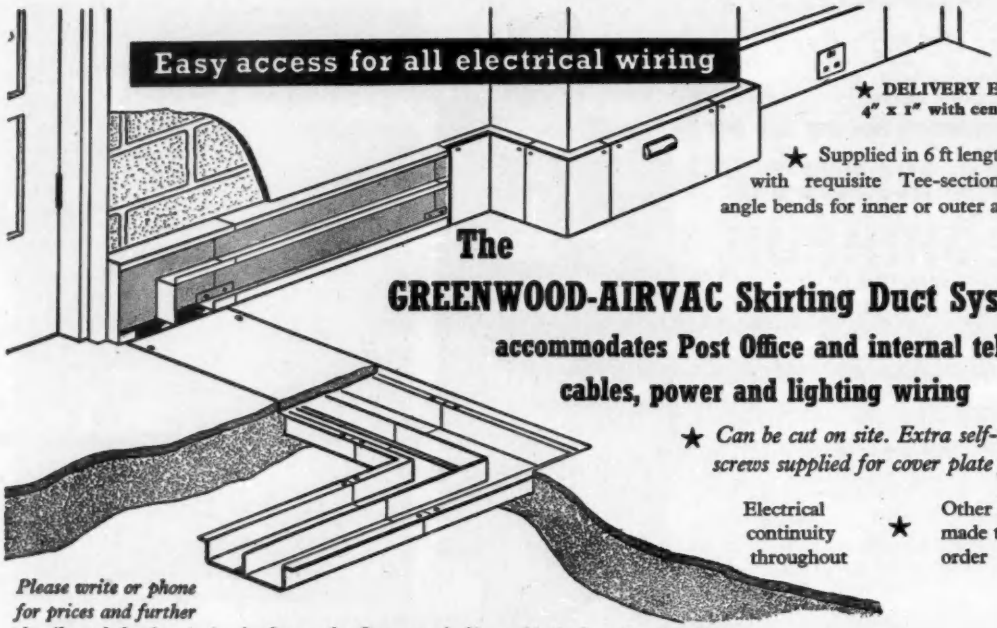

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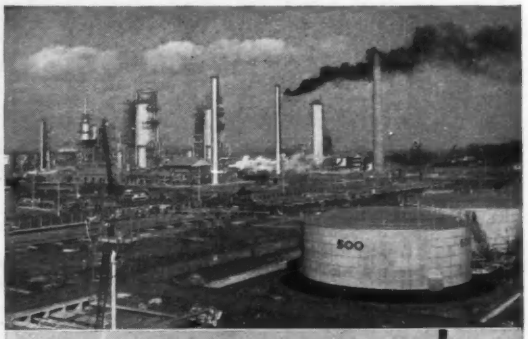

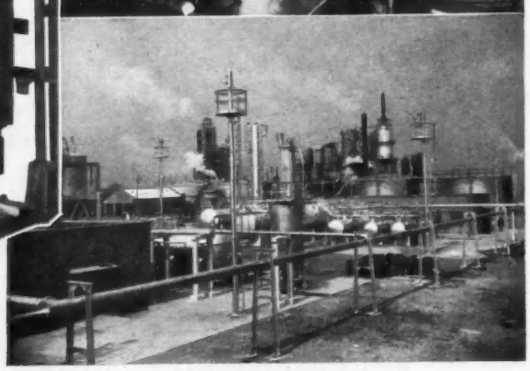

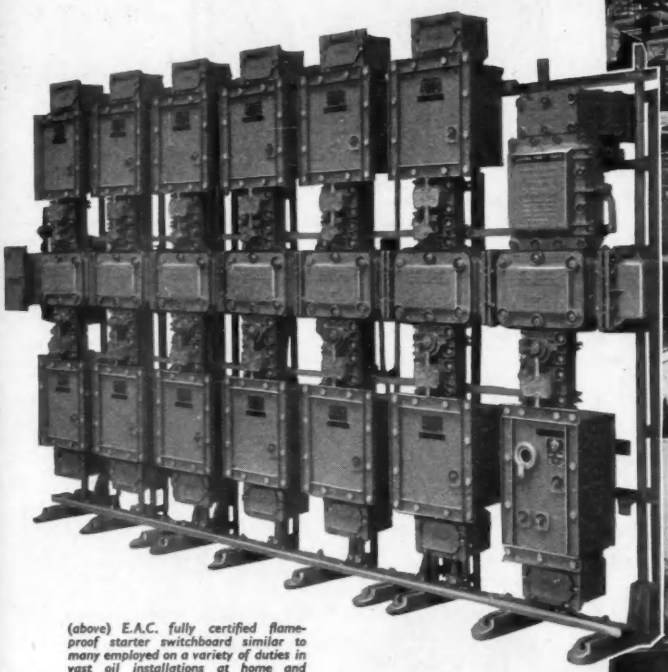

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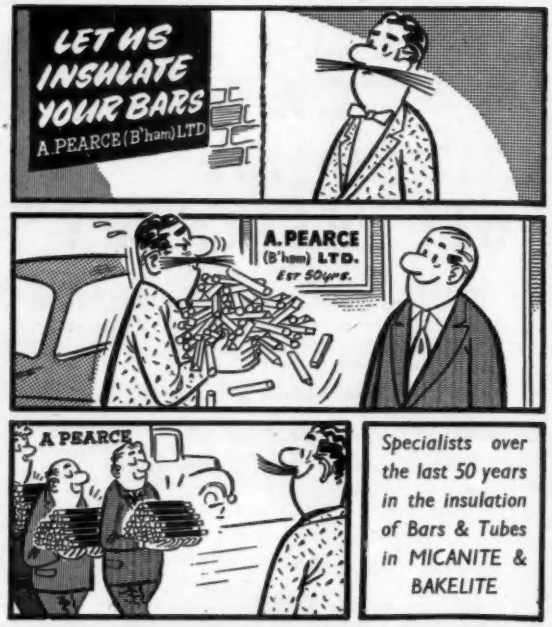

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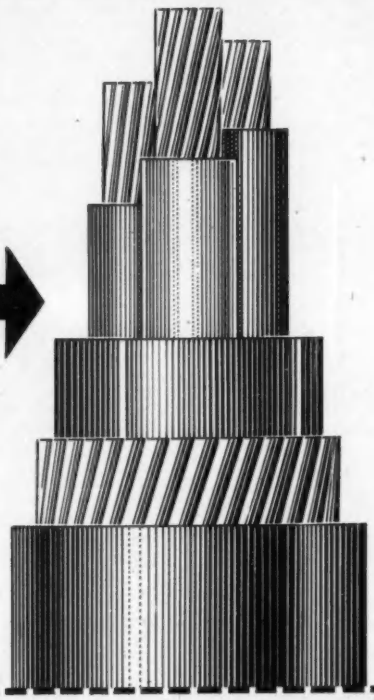

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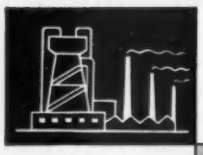

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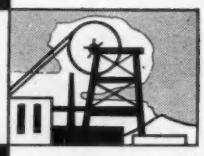

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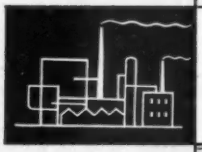

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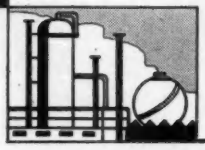

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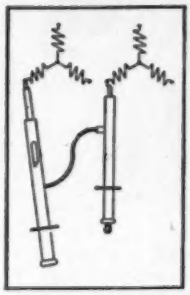

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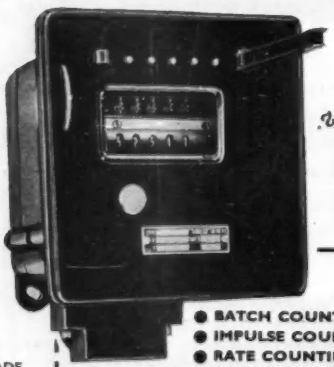

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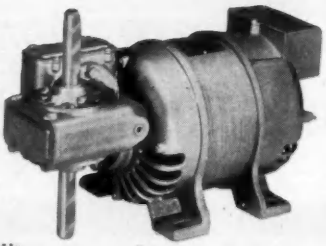

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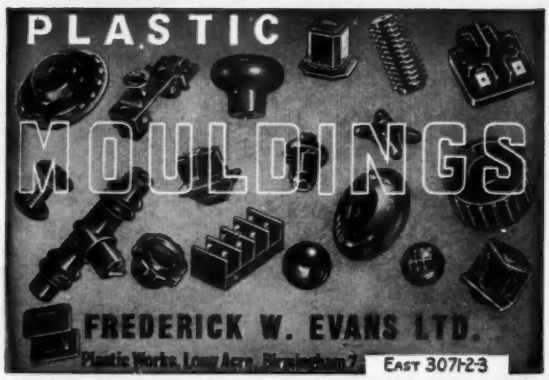

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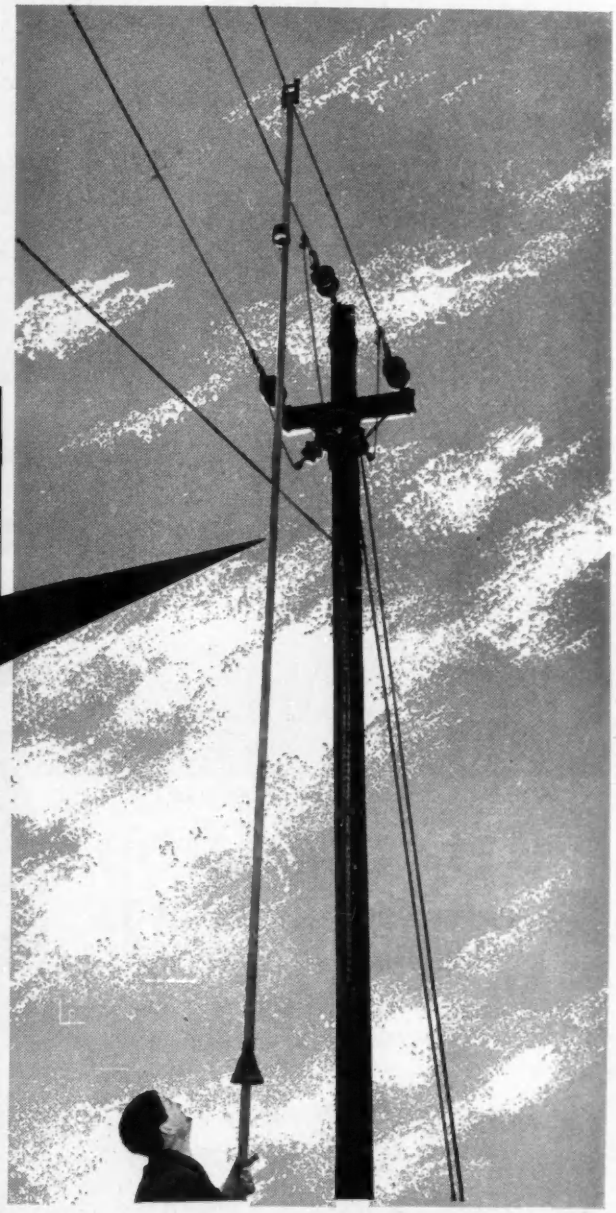

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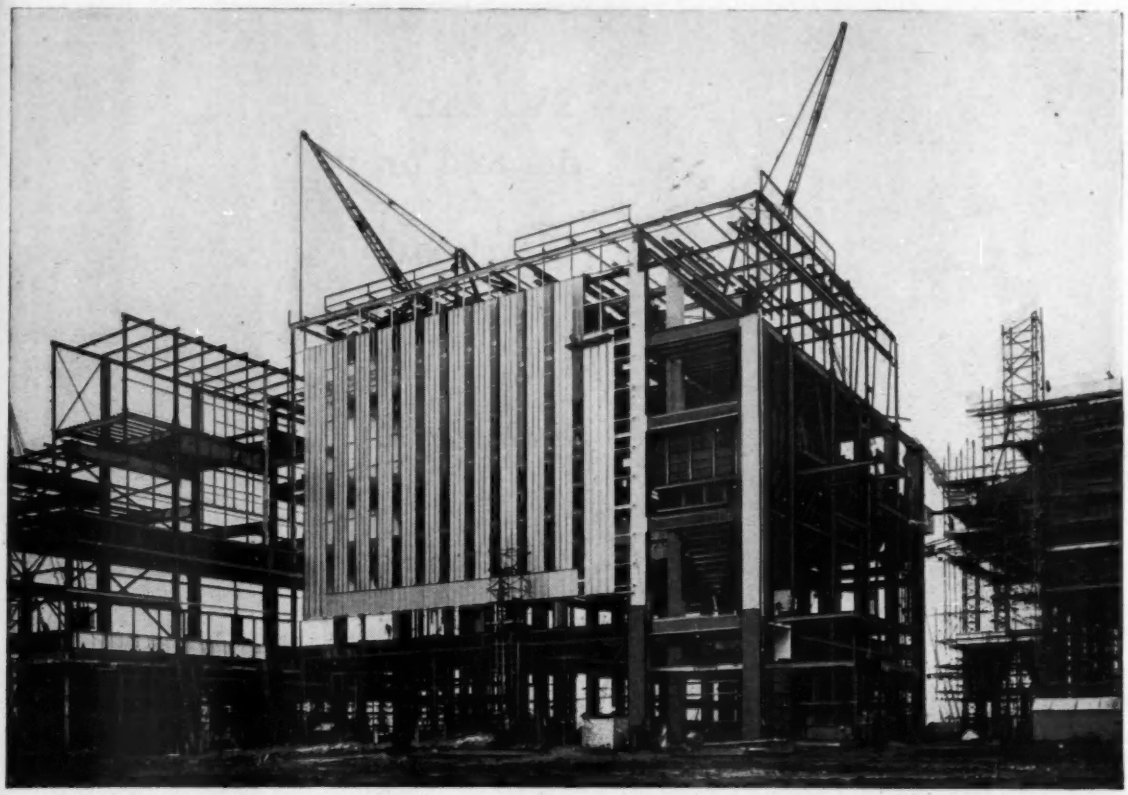


HIGH MARNHAM BOILER UNITS

work advanced on first of five 200 MW units

Construction work is now well under way at High Marnham on the first of the five reheat boiler units which IC are supplying to the CEGB. These five controlled circulation units will be pulverised fuel fired and operate under advanced conditions of temperature and pressure.

Experience of the International Combustion Limited organisation enables them to build steam generation plant to meet the requirements both of the large power station and the industrial boilerhouse.

OPERATING CONDITIONS

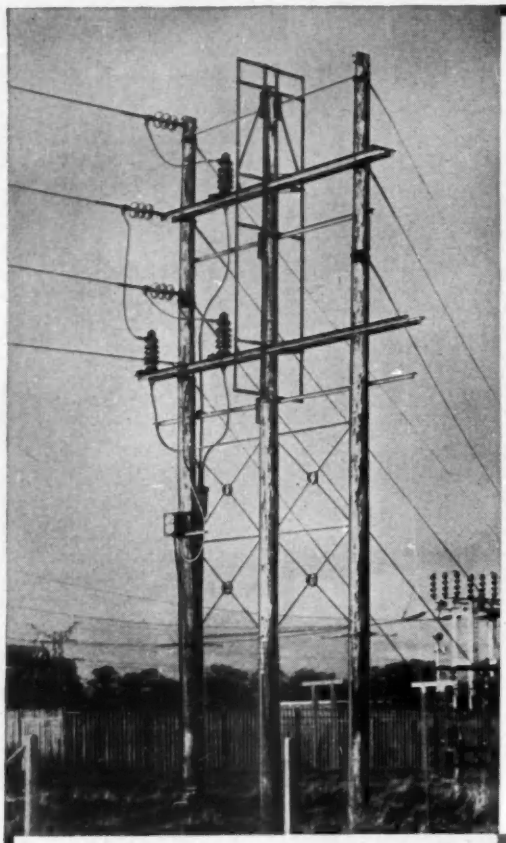
Steam Pressure	2,450 p.s.i.
Superheat Steam Temperature	1,060°F
Reheat Steam Temperature	1,005°F

INTERNATIONAL COMBUSTION LIMITED

NINETEEN WOBURN PLACE · LONDON WC1 · TELEPHONE: TERMINUS 2833 · WORKS: DERBY

Associated with Atomic Power Constructions Limited for Nuclear Power Station Development

TGA 5074



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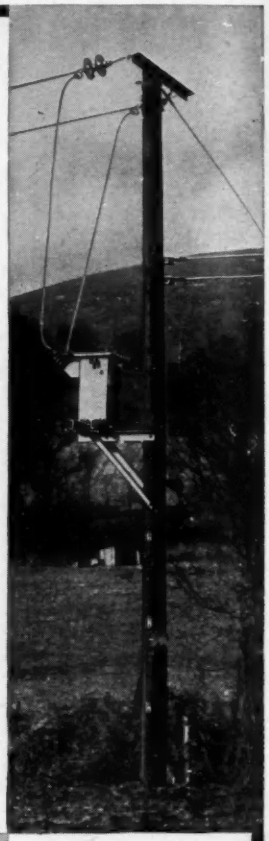
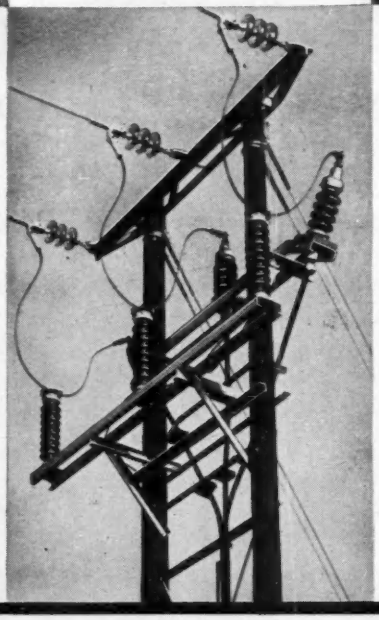
Overhead Transmission Line Equipment

made by

BAYLISS, JONES & BAYLISS LIMITED



Safe, efficient electrical transmission depends on the reliability and toughness of the galvanised forgings and steelwork that make up Transmission Line Equipment – the all-important items Bayliss, Jones & Bayliss have been manufacturing for over half a century and supplying to Electricity Authorities in all parts of the world.



The range of items manufactured includes:

INSULATOR PINS
LINE STRAPS
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DRIVE-IN STEPS
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For details of standard and off-standard components, please write to:

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With the New

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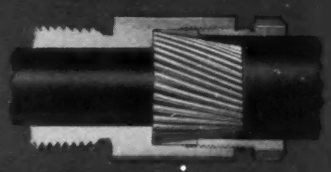

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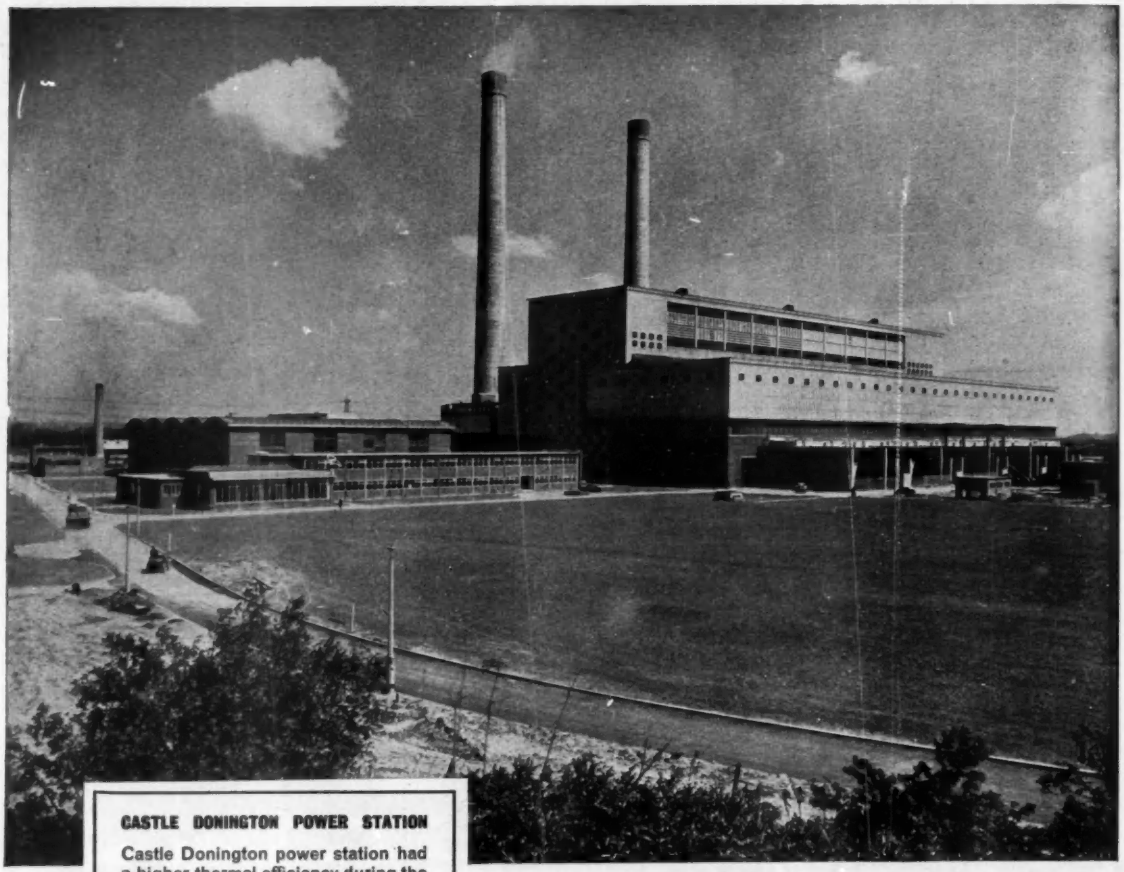

CASTLE DONINGTON POWER STATION

Castle Donington power station had a higher thermal efficiency during the year ended 31st Mar., 1957, than any other power station in Great Britain. The motors driving the auxiliaries are protected by P & B Golds relays in this and many other power stations of the Central Electricity Generating Board.

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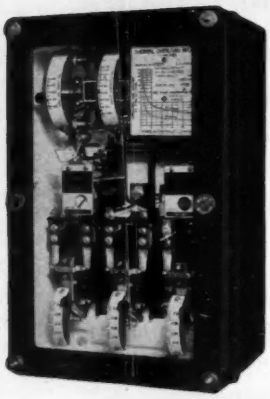

P & B Relays give full protection for motors with any starting periods or currents under extremes of ambient temperature.
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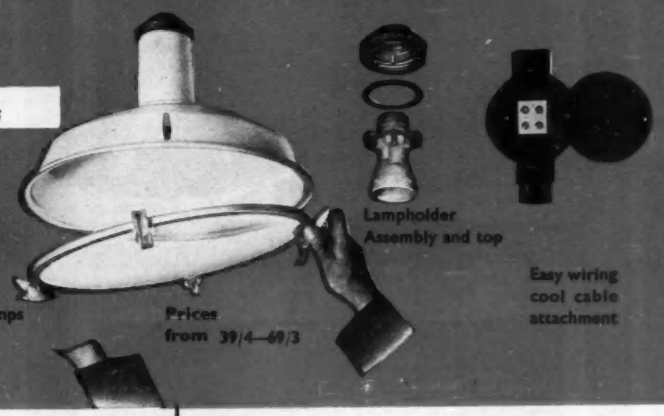

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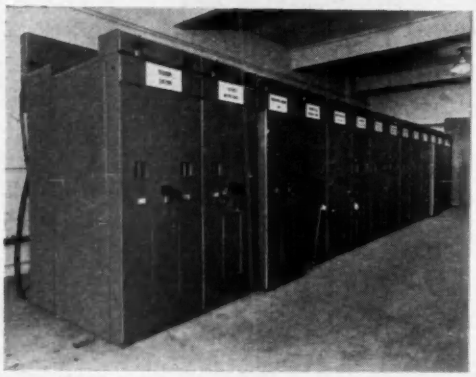
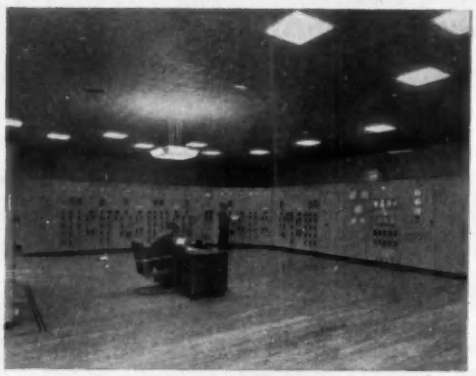
porcelain vitreous enamel is now standard for all Simplex industrial reflectors





REYROLLE AT LACKENBY BEAM MILL

Illustrations show the main 11-kV 350-MVA oil-break switchgear, the 2.75-kV 150-MVA air-break switchgear, and the control-room in Dorman Long's new Beam-Mill at Lackenby.

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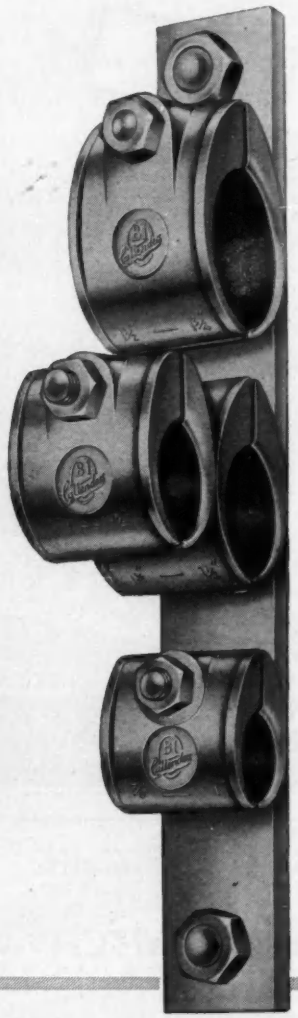

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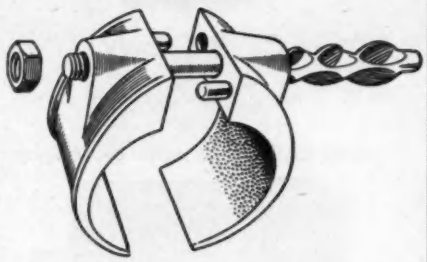

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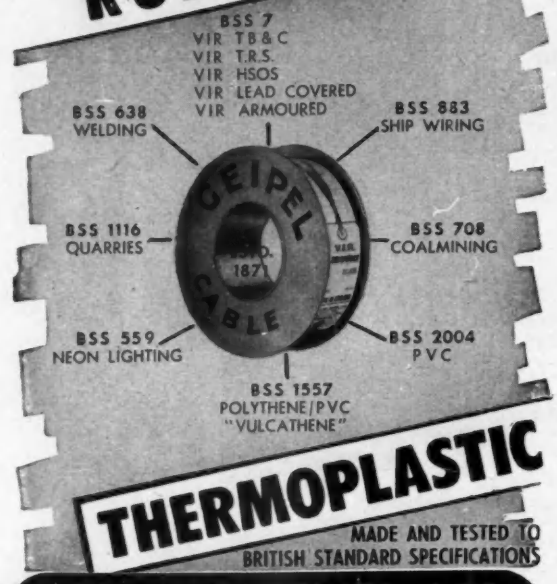

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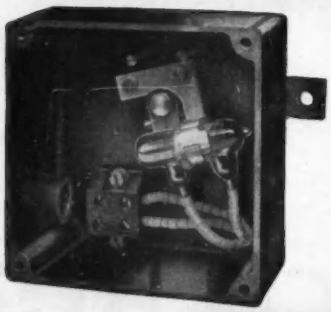

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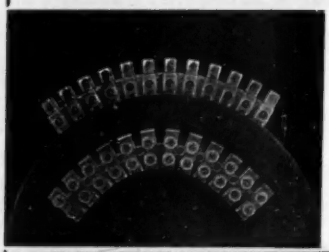

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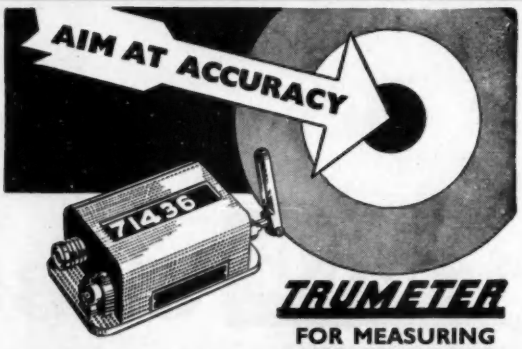

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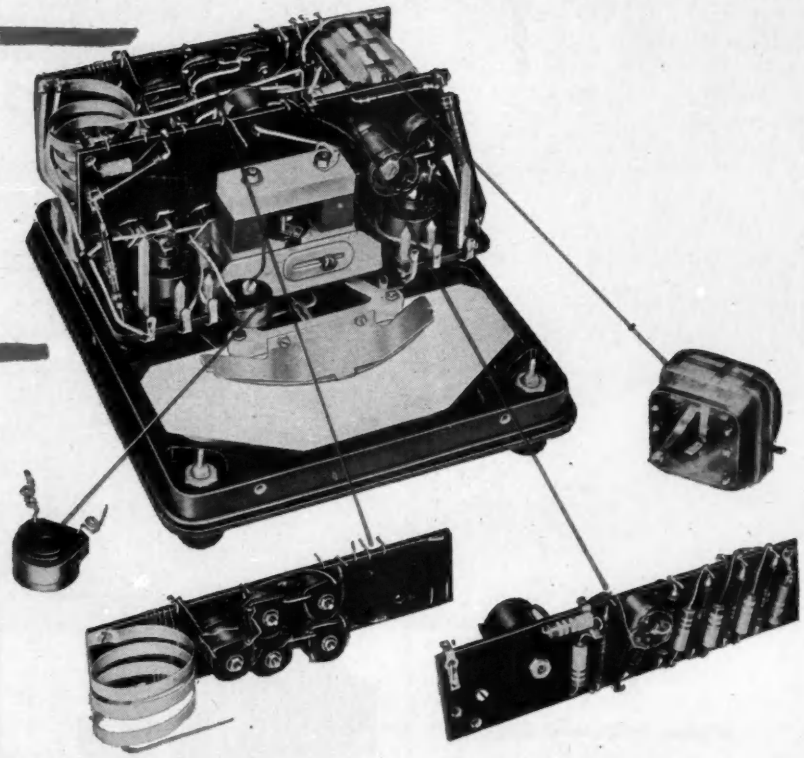

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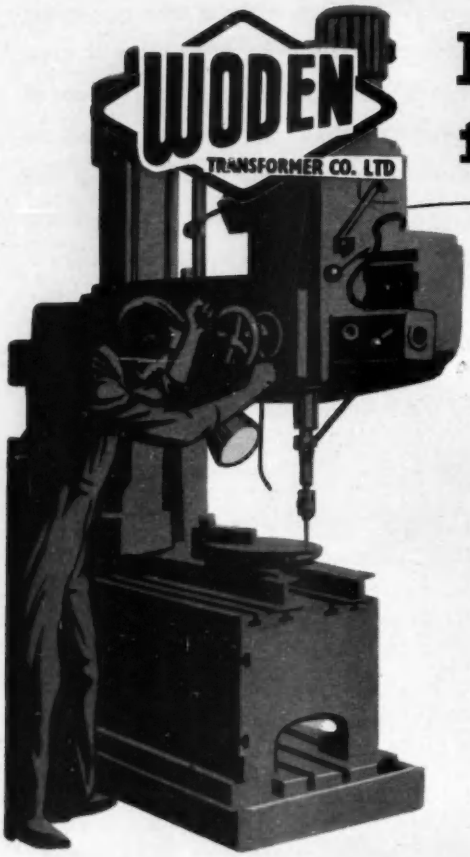

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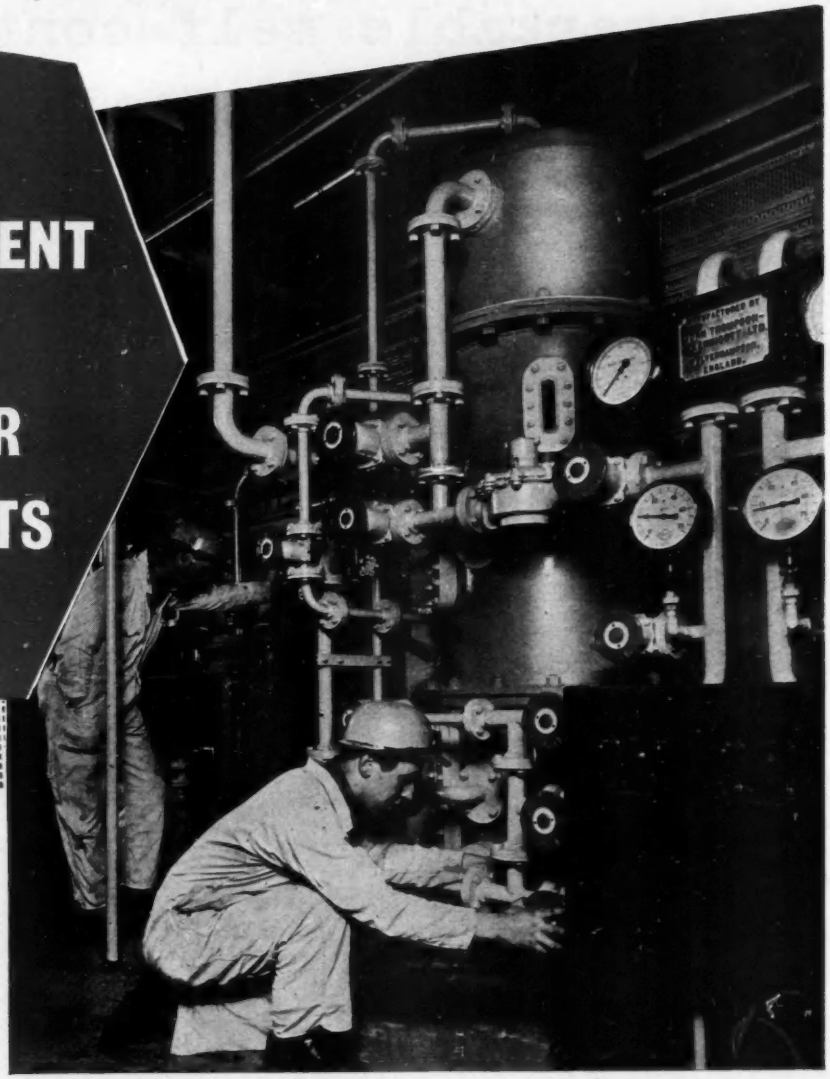

Steam-raising requirements in nuclear projects, as in industry and thermal power generation, demand feed-waters of correct quality for the particular application. The John Thompson-Kennicott mixed-bed de-ionisation units seen here are installed to treat the boiler feed water for the U.K. Atomic Energy Authority's fast reactor at Dounreay.

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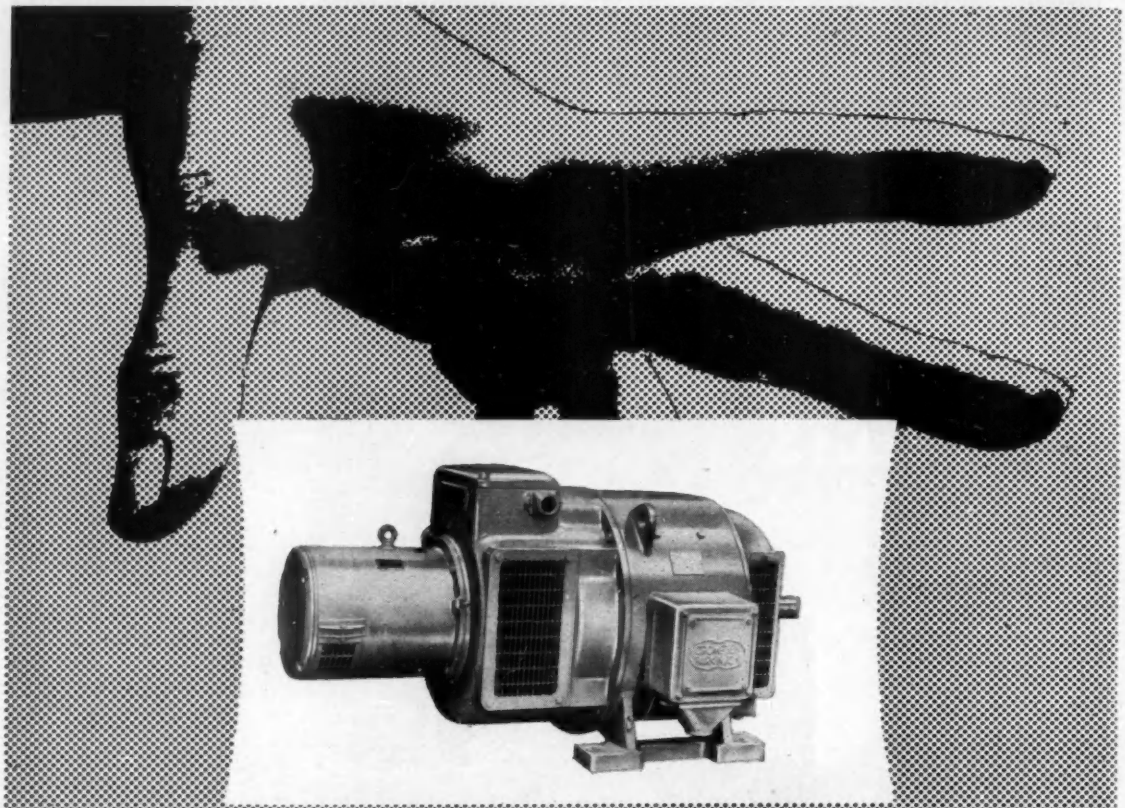

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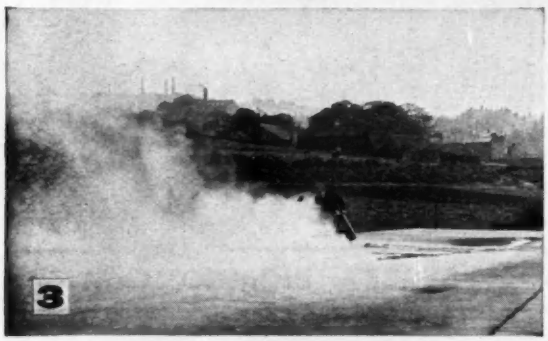

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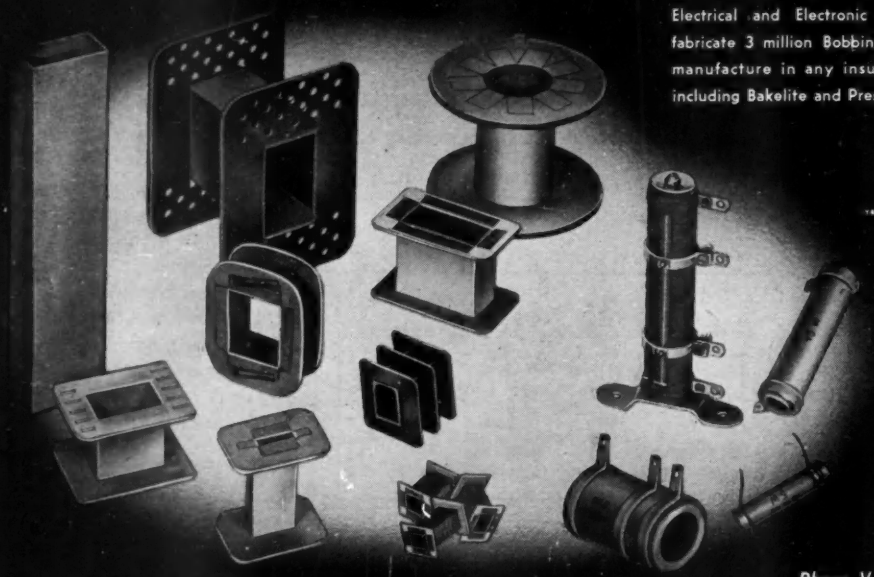

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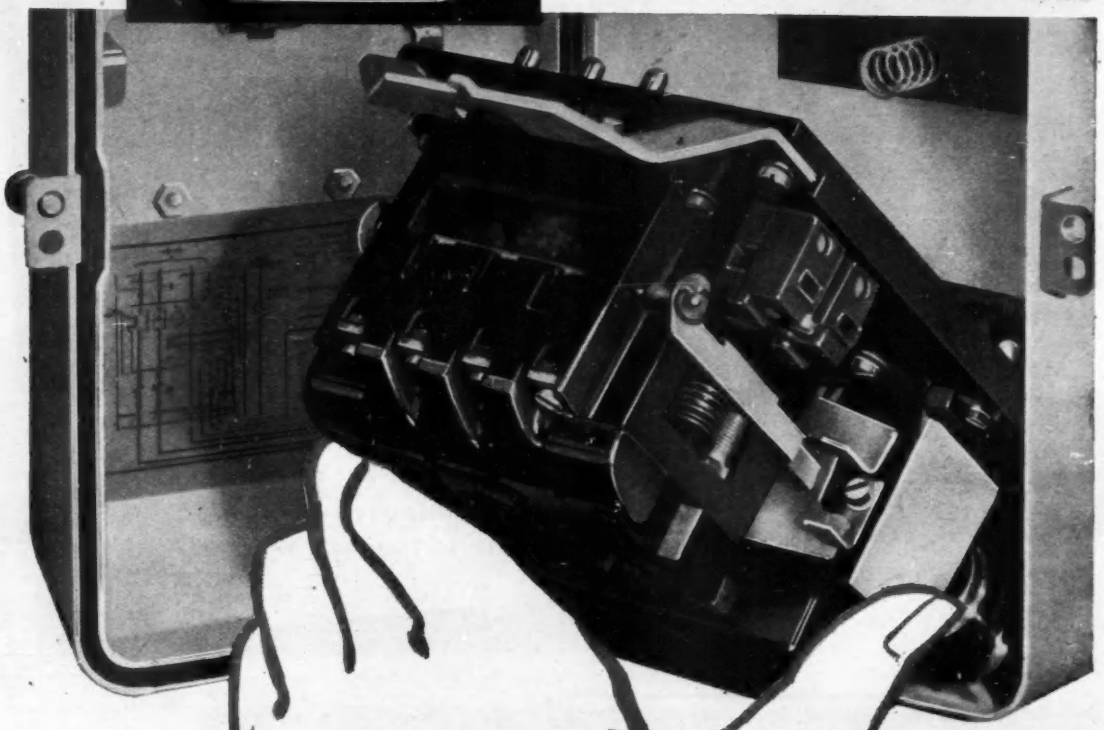

To remove or replace the interior unit of the BROOKHIRST 616 STARTER is a matter of seconds . . .

. . . move switch to 'off' enabling door to be unlocked and completely isolating contactor and overload relay unit. Withdrawal of unit entails no more than releasing a catch; no tools required; no trailing cables to disconnect. Nothing easier for maintenance has ever been available! The 616 starter is suitable for 3-phase squirrel-cage motors up to 7½ H.P. 550 volts. Full details in leaflet 1800.

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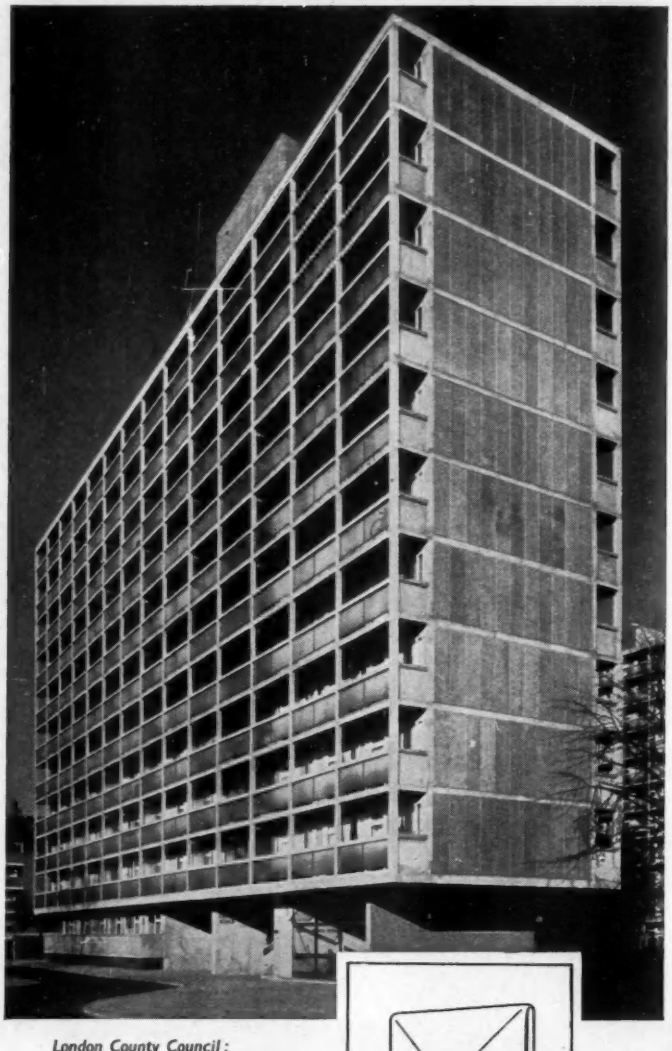

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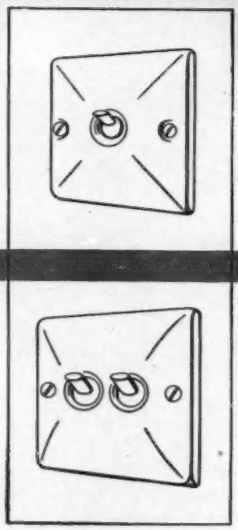
Joseph Rawlinson, Esq., C.B.E., M.Eng., M.I.C.E., M.I.Mech.E.
Chief Engineer to the L.C.C.



Main Contractors:
Tersons Ltd.

Electrical Sub-Contractors:
Haines & Sheppard Ltd.

MUTAC

SILENT A.C. FLUSH SWITCHES

G.E.C. PRODUCTS

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON. W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

ADVERTISEMENTS are accepted up to First Post on Monday of the week of issue and should be addressed to ELECTRICAL REVIEW, Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

BOROUGH OF HEYWOOD

Electrical Installation—108 Dwellings

THE Corporation invite tenders for the electrical installation of 108 dwellings at Heady Hill Estate.

Specification and form of tender may be obtained on application to the Borough Engineer and Surveyor, Municipal Buildings, Heywood, enclosing a deposit of £2 2s., which will be returned on receipt of a bona fide tender. Plans and detailed drawings may be inspected at the Borough Surveyor's Department (Architects' Section).

Tenders to be returned not later than 12 noon on Wednesday, 6th August, 1958, in the envelope provided and endorsed "Electrical Installation—108 Dwellings," and delivered to the Town Clerk, Municipal Buildings, Heywood.

The Corporation does not bind itself to accept the lowest or any tender.

W. R. PARKER,
Town Clerk.

Municipal Buildings,
Heywood,
17th June, 1958. 3952

COUNTY BOROUGH OF BURY

TENDERS invited for :—

(1) Erection of approximately 170 Steel Street Lighting Standards and fitting and wiring of sodium lighting equipment and overhead lines thereto. Standards and equipment to be supplied by the Corporation.

(2) Supply of 170 60-watt Sodium Discharge Lanterns and Lamps.

Forms of tender, specification and general conditions obtainable from Street Lighting Superintendent, Hacking Street, Bury.

Tenders must reach me in plain sealed envelope endorsed "Tender, Street Lighting," not later than 19th July, 1958.

EDWARD S. SMITH,
Town Clerk.

Town Hall, Bury.
19th June, 1958. 3964

BOROUGH OF BARKING

Public Street Lighting

TENDERS are invited for the supply and erection of 104 140-watt Sodium Lamps on 25-ft. mounting height reinforced concrete columns.

Specification, bill of quantities and form of tender are obtainable from the Borough Engineer and Surveyor, Town Hall, Barking.

Tenders with fully priced bills are to be submitted in the envelope provided not later than Tuesday, 8th July.

E. R. FARR,
Town Clerk.

Town Hall,
East Street, Barking. 3927

CITY OF ST. ALBANS

Supply of Sodium Vapour Lanterns

QUOTATIONS are invited for the supply of approx. 150 Group A S.V. Lanterns and 50 Group B S.V. Lanterns.

Forms of tender, together with specification, may be obtained on application to the City Engineer and Surveyor, 16, St. Peter's Street, St. Albans, and should be returned to the undersigned not later than noon on 14th July, 1958.

W. B. MURGATROYD,
Town Clerk.

38, St. Peter's Street,
St. Albans, Herts. 3979

WEST LANCASHIRE RURAL DISTRICT COUNCIL

Street Lighting

Liverpool-Preston Trunk Road A.59: Kirby's Garage to Robin's Bridge Roundabout

THE Council invite tenders for the proposed supply, erection and commissioning of 83 140-watt Sodium Discharge Units, mounted on concrete columns, on the Liverpool-Preston Trunk Road A.59, within the Parishes of Maghull and Lydiate, for approximately 2,335 yards, as follows :—

(a) Supply of concrete columns and brackets.

(b) Supply of transformers, condensers, capacitors, discharge lamps and lanterns.

(c) Erection of concrete columns and brackets and fitting and wiring of electrical equipment, and supplying and fixing of time-switches, fuses, fuse bases and carriers, and all requisites not supplied in (a) or (b), and putting the complete installation into commission.

Tenders may be submitted for any or all of the above three sections.

The drawings and general conditions of contract may be inspected at (i) The West Lancashire R.D.C. Offices, Derby Street, Ormskirk, or (ii) The City Lighting Department, 19, Highfield Street, Liverpool, 3, and specification, bills of quantities and form of tender obtained from the Engineer and Surveyor, West Lancashire R.D.C. Offices, Ormskirk, on payment of a deposit of two guineas, which will be refunded on receipt of a bona fide tender not subsequently withdrawn.

Sealed tenders, in plain envelopes, and marked "Street Lighting," must be delivered to the undersigned not later than 10 a.m. on the 14th July, 1958.

The Council do not bind themselves to accept the lowest or any tender.

WILLIAM RIGBY,
Clerk of the Council.

Council Offices,
52, Derby Street,
Ormskirk. 3939

DORSET COUNTY COUNCIL

TENDERS are invited for the supply of ELECTRIC LAMPS for the School Meals Service and as the County Council may require for any other establishments maintained by them for the period 1st August, 1958, to 31st March, 1960.

Forms of tender and conditions with further particulars may be obtained from the County Education Officer, County Hall, Dorchester.

Tenders must be delivered to the undersigned by 10 a.m. on the 14th July, 1958, in the special envelope provided marked "School Canteens."

The Council do not bind themselves to accept the lowest or any tender.

C. P. BRUTTON,
Clerk of the County Council.

3963

SITUATIONS VACANT

SALES REPRESENTATIVE

required for East London, S.E. England, Norfolk and Cambridge to promote sales of ASHLEY Guaranteed Electrical Installation Accessories. Would suit energetic enthusiast having electrical experience and connections with the electrical trade, etc., in this area.

Salary, commission, expenses, pension scheme. Car provided.

Full letter giving qualifications, career, age, home telephone, etc., confidentially to Sales Director, Ashley Accessories Ltd., Ulverston, N. Lancs. All applications acknowledged. 3866

NOTTINGHAM AND DISTRICT TECHNICAL COLLEGE

Burton Street, Nottingham

Principal:
D. A. R. Clark, M.Sc.(Tech.), M.I.Mech.E.

APPLICATIONS are invited for the following full-time appointment :—

ASSISTANT GRADE B IN ELECTRICAL ENGINEERING, LIGHT CURRENT.

A large new building comes into use in September next for well-equipped Departments of Building and Civil Engineering, Electrical Engineering, Chemistry, Physics and Mathematics, and Mining. Increased accommodation is also available to the Departments of Mechanical Engineering, Arts and Commerce, Printing and Textiles. Research work by both staff and students is being rapidly developed.

Experience in industry, teaching and/or research desirable.

Salary in accordance with the Burnham Technical Scale as follows: £650 × £25 to £1,025 per annum. Additions for Assistants include degree allowance of £75 per annum (or £125 for good honours degree), up to 3 increments of £25 for training in approved cases, and incremental allowance for industrial experience after age 21, and war service.

Further particulars and form of application may be obtained from the Principal, to whom completed forms should be returned not later than 11th July, 1958. 3981

POSTGRADUATE TRAINEES: ELECTRICAL ENGINEERING

THE FIRST ELECTRIC CORPORATION OF SOUTH AFRICA LTD., JOHANNESBURG, manufacturers of Motors, Transformers, Switchgear, Rectifiers, etc., have vacancies for Postgraduate Electrical Engineering Trainees for their 2-year course covering all aspects of the business, including foundry. Applicants should possess a B.Sc. (Electrical) degree or equivalent diploma.

Commencing salary £60 per month. Successful applicants will be assisted with travelling expenses to the Union of South Africa.

Please apply to "EGE," Crown House, Aldwych, London, W.C.2.

3945

ENGINEERS FOR THE DEVELOPMENT OF RAILWAY SIGNALLING APPARATUS

SEVERAL ENGINEERS are required for work on signals, track apparatus, relays, relay racks, control panels, remote control systems, automatic train control, automatic control of marshalling yards, etc. Previous experience of this type of work is not essential, but for some of the positions a knowledge of electronics will be an advantage.

The minimum technical qualification required is the Higher National Certificate (or equivalent).

These positions are pensionable and based on Trafford Park.

Write for application form, quoting reference K.11, to :—

Personnel Manager
METROPOLITAN-VICKERS ELECTRICAL CO. LTD.
Trafford Park, Manchester, 17

3880

***Situations Vacant** (continued)*

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area

THIRD ASSISTANT ENGINEER (Distribution Design).

Applicants should be Graduate Members of the Institution of Electrical Engineers or hold equivalent qualifications, and have had experience in the design, construction, operation and maintenance of H.V. and L.V. underground and overhead distribution systems, substation plant and ancillary equipment.

Salary N.J.B. Class K, Grade 10, £935/£20/£995 per annum.

HULL DISTRICT

ASSISTANT CONSUMERS' ENGINEER.

Applicants should have had a sound technical training and practical experience of industrial, commercial and domestic installations. They should be capable of carrying out negotiations with consumers for new and additional supplies, preparing electrical schemes and specifications, and will be required to render general assistance to the Power Sales Engineer in dealing with the utilisation of electricity in industrial premises. A knowledge of D.C./A.C. change-over will be an advantage.

Candidates must hold at least the Ordinary National Certificate in Electrical Engineering, or equivalent qualifications.

Salary N.J.B. Class J, Grade 13, £740/£15/£785 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 11th July, 1958.

No. 7 (Grimsby) Sub-Area

THIRD ASSISTANT DISTRICT ENGINEERS.

Applicants should be of Higher National Certificate standard in electrical engineering and should have some experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

The posts are located at Grimsby, Louth and Scunthorpe.

Salary N.J.B. Class G, Grade 9, £835/£15/£880 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 11th July, 1958.

No. 4 (Leeds) Sub-Area

SENIOR DRAUGHTSMAN (Electrical).

Applicants should have had a good general and technical education and be experienced in the layout of plant in substations and in the preparation of electrical diagrams.

Possession of the National Certificate in Electrical Engineering will be an advantage.

Salary N.J.B. Schedule D, Grade 5, £760/£20/£860 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Nr. Leeds, not later than 11th July, 1958. 3965

AIR MINISTRY

WORKS Design Branch requires in LONDON and PROVINCES ELECTRICAL ENGINEERING DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution, H.V. and M.V. Technical training to O.N.C. standard or equivalent an advantage.

Salaries in London up to £870 p.a. Somewhat lower in Provinces. Starting pay dependent on age, qualifications and experience. Long-term possibilities with promotion and pensionable prospects. 5-day week, 3 weeks 3 days leave a year.

Liability for overseas service. Normally natural-born British subjects.

Write stating age, qualifications, employment details, including type of work done, to any Employment Exchange, quoting Order No. BOROUGH 104. 253

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

APPLICATIONS are invited for the position of THIRD ASSISTANT ENGINEER in the Testing Section of the Department of the Chief Generation Engineer (Operation). This is a superannuable appointment under N.J.B. service conditions, commencing salary within Grade 6 of Schedule B of the agreement covering the range £895-£1,020 per annum, ultimately rising to £1,140 per annum.

The successful applicant will act as deputy to the engineer in charge of non-destructive testing. Testing methods in use include radiography, ultrasonics and penetrants.

Applicants should possess academic qualifications sufficient to demonstrate their ability both to understand the theoretical background of this type of work and to organise research and development of new techniques. Although practical experience of non-destructive testing, preferably including radiography, is of great importance, the primary requirement is a man capable of making a sound theoretical approach to the many interesting problems in this field.

Apply, quoting Vacancy No. 823MD, on form AE6, available from the Establishments Officer, 53, Wake Green Rd., Moseley, Birmingham, 13, not later than 10th July, 1958. 3942

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

Fourth Assistant Engineer, Non-Destructive Testing Section, Generation Operation Department, Portsmouth

THE successful applicant will be concerned primarily with the repair and maintenance of electronic and other instruments and equipment. There will also be opportunities to assist with the construction of experimental equipment. Some experience of technical records and stores would be an advantage.

Salary N.J.B. AX/DX, Grade 8, £710-£910.

Special application forms obtainable from P. D. A. Oliver, Divisional Secretary, Central Electricity House, High Street, Portsmouth, should be returned by 9th July, 1958. 3980

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following appointments in this Division:—

FOURTH ASSISTANT ENGINEER, STAYTHORPE TRANSMISSION SECTION (Vacancy No. 95/58/ER).

Applicants should have experience of the maintenance and operation of E.H.T. overhead lines, transformer and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£710-£935 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 2nd July, 1958.

FOURTH ASSISTANT ENGINEER, DRAKELOW TRANSMISSION SECTION (Vacancy No. 96/58/ER).

Applicants should have experience of the maintenance and operation of E.H.T. overhead lines, transformer and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£710-£935 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 2nd July, 1958.

THIRD ASSISTANT ENGINEER (Electrical), GENERATION (Construction) DEPT., CASTLE DONINGTON POWER STATION SITE (Vacancy No. 94/58/ER).

Applicants should have had a fundamental training in electrical engineering, including workshops and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern power stations. Preference will be given to candidates who possess a degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Class AX/EX, Grade 6 (£895-£1,140 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 2nd July, 1958.

ENGINEERING DRAUGHTSMAN (Civil), CONSTRUCTION DEPARTMENT, NORTH WILFORD POWER STATION (Vacancy No. 97/58/ER).

Applicants should have experience in design and detail of reinforced concrete structure, piled and slab foundations for heavy plant, culverts, cable subways, etc., for general building construction drainage and sanitation schemes, associated with official and administrative buildings.

The salary will be in accordance with Grade 6 (£595-£715 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 2nd July, 1958.

STATION SHIFT CONTROL ENGINEER, CASTLE DONINGTON POWER STATION (Vacancy No. 98/58/ER).

Applicants should have had a sound training and practical experience in a modern power station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be an advantage.

Salary will be in accordance with Class L, Grade 10 (£995-£1,055 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 2nd July, 1958.

SECOND ASSISTANT CHEMIST, DERBY POWER STATION (Vacancy No. 101/58/ER).

Candidates should preferably hold the Higher National Certificate in Chemistry and should have had some previous experience in a power station laboratory. They should be familiar with the methods of sampling and analysis of coal, water and oil, and with the interpretation and application of analytical results.

Salary will be in accordance with Class F, Grade 11 (£685/£730 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 9th July, 1958.

SENIOR DRAUGHTSMAN (Mechanical), GENERATION (Construction) DEPT., DIVISIONAL HEADQUARTERS. (Vacancy No. 100/58/ER).

Candidates should have experience on one or more of the following :—

(i) Design and layout of power station equipment, including turbo-alternators, boiler plant, coal and ash plant and general station auxiliaries.

(ii) H.P. and L.P. steam and feed pipework. Condensing plant and feed heating systems.

(iii) Conveyor plant, coal handling systems and material handling of station auxiliary equipment.

Salary will be in accordance with Grade 5 (£760-£860 per annum) or Grade 4 (£895-£995 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 9th July, 1958.

STATION CLERK, HIGH MARNHAM POWER STATION (Vacancy No. 102/58/ER).

Applicants should have had experience in the clerical and administrative work of a power station, including stores accounting, calculation and payment of wages and work in connection with suppliers' accounts.

The salary will be in accordance with Grade 5 (£855-£930 per annum) of the National Joint Council Agreement.

Closing date for receipt of applications, 9th July, 1958.

These appointments will be pensionable under the terms of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form **AB6/ACT**, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. PLEASE QUOTE VACANCY NUMBER.

L. F. JEFFREY,
Divisional Controller.

19th June, 1958. 3958

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or B. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (a) and Corporate Membership for posts (b) an advantage.

(b) OPERATION AND EFFICIENCY ENGINEER,
BARKING "C" POWER STATION
(Vacancy No. 58/437).

Candidates should have had considerable experience in maintaining maximum efficiency of large modern power plant, together with appreciation of modern concepts of personnel management.

Salary Class J, Grade 5 = £1,285 p.a.

(a) STATION SHIFT CONTROL ENGINEER,
DEPTFORD WEST POWER STATION
(Vacancy No. 58/438).

Candidates should have suitable technical qualifications and previous practical experience in the control and operation of steam generating plant and H.T. switchgear.

Salary Class J, Grade 10 = £935 p.a. plus £88 10s. p.a. shift allowance.

(a) ASSISTANT SHIFT CHARGE ENGINEER, BLACKWALL POINT POWER STATION
(Vacancy No. 58/439).

Sound technical training necessary with practical experience in operation of modern power station, preferably with pulverised fuel firing.

Salary Class F, Grade 9 = £830 p.a. plus £79 p.a. shift allowance.

(a) FOURTH ASSISTANT ENGINEERS, TRANSMISSION DEPARTMENT
(Vacancy No. 58/440).

Candidates should have had experience in operation and maintenance of a H.V. transmission system or manufacturer's training on H.V. switchgear and transformers. Applicants to Vacancy 58/256, 9th April, 1958, need not re-apply.

Salary Class AX/EX, Grade 8 = £750/£985 per annum.

(a) ASSISTANT MAINTENANCE ENGINEER (Mechanical),
BELVEDERE POWER STATION
(Vacancy No. 58/441).

Candidates should be qualified technically and with mechanical maintenance experience on large modern boiler and turbine plant and auxiliaries. Character and ability to supervise staff is important.

Salary Class L, Grade 8 = £1,210 p.a.

(a) ASSISTANT MAINTENANCE ENGINEER (Electrical),
BELVEDERE POWER STATION
(Vacancy No. 58/442).

Candidates should be qualified technically and with electrical maintenance experience on large modern turbo-alternators, switchgear and electrical plant generally. Character and ability to supervise staff is important.

Salary Class L, Grade 8 = £1,210 p.a.

Applications, quoting vacancy number, to (or on form from) Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 7th July, 1958, for Vacancy Nos. 58/437-440, and 14th July, 1958, for Vacancy Nos. 58/441-442. 3943

A.E.R.E., HARWELL

ASSISTANT DESIGN ENGINEERS and DRAUGHTSMEN

EXCELLENT career prospects in individual and team work in connection with the Controlled Thermonuclear Reaction Project.

Housing; superannuation.

A.D.E. posts: apprenticeship, H.N.C. or equivalent and good design office experience.

Salary range £880 - £1,270.

Draughtsmen posts: apprenticeship or at least 3 years' approved practical experience, adequate drawing office experience, and O.N.C. or equivalent.

Salary range £555 (at 21) - £865.

Send POST CARD to Group Recruitment Officer (1145Y/48), A.E.R.E., Harwell, Didcot, Berks., for further details and application form. 3966

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER,
Sutton District.

Salary £885 × £15 to £930 per annum, plus London allowance under N.J.B. Class F, Grade 7. Superannuable. Applicants, preferably Corporate Members of the I.E.E., should have had responsible experience and practice in the planning, construction, operation and maintenance of underground and overhead distribution networks. Experience of distribution in thickly populated urban areas an advantage. Applications received in response to the advertising of this appointment in February will be considered and should not be resubmitted.

Applications naming 2 referees on forms from Sutton District Manager, SEEBOARD, 52, High Street, Sutton, Surrey, by 9th July, 1958.

ASSISTANT DISTRICT ENGINEER,
Sutton District.

Salary £685 × £15 to £730 per annum, plus London allowance under N.J.B. Class F, Grade 11. Superannuable. Applicants should possess the Higher National Certificate in Electrical Engineering and have had a thorough training in underground and overhead distribution systems.

Applications naming 2 referees on forms from Sutton District Manager, SEEBOARD, 52, High Street, Sutton, Surrey, by 9th July, 1958.

ASSISTANT DISTRICT ENGINEER,
Medway District.

Salary £835 × £15 to £880 under N.J.B. Class F, Grade 8. Superannuable. The district has a considerable amount of varied industry, in addition to domestic and commercial loads. Candidates should preferably hold the Higher National Certificate or equivalent, and practical experience in the operation, maintenance and construction of 11-kV and medium voltage underground and overhead systems. Knowledge of the preparation of extension and reinforcement schemes an advantage.

Applications naming 2 referees to Medway District Manager, SEEBOARD, Gardiner Street, Gillingham, Kent, by 9th July, 1958.

SENIOR DEMONSTRATOR,
Crawley and Horsham District.

Salary £615 × £20 to £675 p.a. under N.J.C. Grade 2. Superannuable. Applicants should possess recognised diploma or certificate in domestic science, also E.A.W. Certificate. Duties include lecturing, demonstrating, advising consumers and generally assisting in any of the district's showrooms.

Applications naming 2 referees to Crawley and Horsham District Manager, SEEBOARD, 32/40, North Street, Horsham, Sussex, by 9th July, 1958.

G. WRAY,
Secretary.
3969

COMPUTER ENGINEERS

ENGLISH ELECTRIC is considerably expanding its activities in the field of Digital Computers, and a number of qualified Engineers are required for their new Computer Laboratories, pleasantly located on the Staffordshire/Cheshire border.

Qualifications for these positions are normally a Degree or H.N.C., but consideration will be given to applicants with experience in pulse circuitry.

Unfurnished tenancies of recently built houses will be available after an initial period, the company operates an attractive staff pension scheme, and monthly staff are entitled to three weeks' holiday from next year.

Please write giving full details to—

Dept. C.P.S.
336/7, The Strand, London, W.C.2

quoting reference ER.306L.

3961

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Planning)

Basingstoke District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class E, Grade 10 (£685 × £15 to £730 per annum). N.J.B. conditions of service.

The successful candidate will be required to assist the planning engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in electricity supply distribution and the possession of suitable technical qualifications would be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him, quoting Z.905, in envelopes suitably endorsed, not later than 7th July, 1958.

Wayleave Officer

Newbury District of No. 2 (Newbury) Sub-Area. Salary N.J.C. Grade 2 (£615-£675 per annum). N.J.C. conditions of service.

Qualifications required are an ability to negotiate Wayleave Agreements for the erection or laying of electric lines and installation of substation plant.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks, and returned to him, quoting Z.918, in envelopes suitably endorsed, not later than 7th July, 1958.

Demonstrator

Reading District of No. 2 (Newbury) Sub-Area, located at High Wycombe. Salary N.J.C. Grade 1 (£500-£600 per annum). N.J.C. conditions of service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent Domestic Science qualification would be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks, and returned to him, quoting Z.920, in envelopes suitably endorsed, not later than 7th July, 1958.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. 3967

HUDDERSFIELD COLLEGE OF TECHNOLOGY

Principal: Dr. W. E. Scott, M.B.E.

DEPARTMENT OF ELECTRICAL ENGINEERING

REQUIRED September, 1958, or as soon afterwards as possible, LECTURER in Electrical Engineering able to teach Electrical Measurements to Advanced Level in Higher National Diploma and Certificate courses. Applicants should be graduates of a British university and have had practical and teaching experience.

The salary (Burnham Scale) rises to a maximum of £1,350 p.a. (women £1,080 p.a., plus the gradual introduction of equal pay).

Further particulars and forms of application, which must be returned as soon as possible, obtainable from the Principal, College of Technology, Queen Street South, Huddersfield.

H. GRAY,
Chief Education Officer.
17th June, 1958. 3960

MIDDLESEX COUNTY COUNCIL EDUCATION COMMITTEE

GENERAL MAINTENANCE ENGINEER required at Brunel College of Technology, Woodlands Avenue, Acton, London, W.3. Salary £575 to £725 p.a. plus London weighting. 44-hr. week. Should have sound knowledge of the operation of central heating and domestic hot water services, gas and extract ventilation installations, and of electric lighting and power installations. Prescribed conditions.

Apply giving qualifications, previous experience and names of two referees to Principal, above address, by 9th July (quote X.693 ER). Canvassing disqualifies. 3930

Situations Vacant (continued)

CITY AND COUNTY OF KINGSTON UPON HULL

Water Department

Appointment of Works Engineer

APPLICATIONS are invited for the post of WORKS ENGINEER at a large river abstraction works, capacity 12 m.g.d.

Applicants must be particularly experienced in the running and maintenance of alternators, associated switchgear and electric motors, chlorination and filtration plants, and possess a sound general knowledge of diesel engines and centrifugal pumps.

The salary is within Grade III, A.P.T. Division, of the National Joint Council's Scales (£845 to £1,025 per annum), according to experience.

The person appointed will be required to reside on the site, where housing accommodation will be provided at a reasonable rent.

The appointment will be subject to one month's notice on either side, to the National Scheme of Conditions of Service, and, being superannuable, will be subject to the passing of a medical examination.

Applications, stating age, details of experience, together with copies of two recent testimonials, should be forwarded to the undersigned not later than 10 a.m. on Monday, the 14th July, 1958.

Canvassing a member of the City Council or any chief officer will be a disqualification.

T. H. JONES, M.I.C.E.,
Water Dept., Engineer and Manager.
Alfred Gelder Street,
Kingston upon Hull. 3944

ELECTRICAL DESIGNER

THE world's leading inventors and manufacturers of special-purpose precision machinery for the tobacco industry have opening in their London drawing office for :—

ELECTRICAL DESIGNER.

Desirable applicant should be aged 25-40, with technical qualifications at least up to H.N.C. level and with a broad background of experience in the design of electrical and electro-mechanical equipment as applied to precision machinery.

This opportunity is permanent and progressive ; it offers immediate pensionable monthly staff position with 3 weeks' annual holiday and other advantages.

Applications stating age, qualifications and experience should be personally addressed in confidence to G. B. Salmon.

MOLINS MACHINE CO. LTD.
Evelyn Street, London, S.E.8

3878

CENTRAL ELECTRICITY GENERATING BOARD

Instrument Engineers

INSTRUMENT ENGINEERS required in Electronics and Instruments Section of the Research Laboratories, Leatherhead, Surrey. The section provides an instrument service for all departments of the laboratories and duties include the maintenance, calibration and repair of the wide variety of physical, chemical and electrical instruments.

Candidates should have the Higher National Certificate or equivalent qualification. Experience in electronic or nucleonic equipment will be an advantage.

Salaries within scales £820 - £995 p.a. or £550 - £725 p.a.

Applications stating age, qualifications, experience, present position and salary should be forwarded to S. S. Scott, Chief Personnel Officer, 24/30, Holborn, London, E.C.1, by 14th July. Envelopes should be marked "Confidential." Ref. ER/166. 3941

CENTRAL ELECTRICITY GENERATING BOARD

Research Laboratories, Leatherhead, Surrey

APPLICATIONS are invited for the appointment of ASSISTANT ENGINEERS to work at the RESEARCH LABORATORIES AT LEATHERHEAD, SURREY, on a wide range of problems associated with conventional and nuclear power stations. Present investigations concern heat transfer in nuclear fuel elements and heat exchangers, electrostatic precipitators, cooling towers and boiler feed pumps.

Candidates for senior vacancies should have an honours degree with previous research experience ; for other vacancies a pass degree or H.N.C. with appropriate experience would be acceptable, but importance is attached to ability to apply fundamental knowledge to a wide range of problems.

Salary according to ability and experience : £1,160-£1,510 per annum, £1,055-£1,265 per annum, £820-£995 per annum, £550-£725 per annum.

Application forms from S. S. Scott, Chief Personnel Officer, Central Electricity Generating Board, 24/30, Holborn, London, E.C.1, to be returned by 14th July. Envelopes should be marked "Confidential," Ref. ER/169. 3957

BABCOCK & WILCOX LIMITED

Atomic Energy Department

require

CONTROL AND INSTRUMENT ENGINEERS

for work on land-based and marine nuclear power plant.

Engineers with suitable experience are required for control and instrumentation system design in the industrial application of atomic energy, which includes control and instrumentation of reactors, steam raising plant and mechanical handling plant.

Apply, giving full particulars of education and experience, to :—

The Assistant Secretary
Babcock & Wilcox Limited
209, Euston Road, London, N.W.1

3915

ELECTRIC MOTOR SALESMAN

MANUFACTURERS of high-quality electric motors (A.C. and D.C.) offer an opportunity to young engineer to join their sales staff. Candidates, age 23 - 28, should have an electrical engineering apprenticeship and at least O.N.C. or equivalent qualification. Salary and expenses will be paid initially, and commission in addition as soon as this is justified. The prospects are unusually good for both earnings and advancement. Previous selling experience is an advantage but not essential. Please reply in confidence to—Box 3917.

NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the appointment of FIRST ASSISTANT DISTRICT ENGINEER, Hesledon District. Applicants must be qualified electrical engineers with sound practical training and experience in construction, operation and maintenance of overhead and underground networks and associated plant and equipment. Salary Schedule A, Class F, Grade 4, £1,065/£1,140. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by the Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 3968

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division
Our Ref. 149/9/4/RS/EB

APPLICATIONS invited for the following superannuable N.J.B. appointments in this Division :—

SHIFT CHARGE ENGINEER,
LLANELLY POWER STATION
(Vacancy No. 61/ER/58).

Salary E.7, £835-£880 per annum. Appropriate engineering qualifications and regular apprenticeship desirable.

ASSISTANT ENGINEER
(Combustion and Efficiency),
CARDIFF POWER STATION
(Vacancy No. 64/ER/58).

Salary F.7, £885-£930 per annum. Applicants should preferably have obtained H.N.C. and served a regular apprenticeship. Power station experience and knowledge of automatic combustion control equipment desirable.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd., Gabalfa, Cardiff, to be returned by 7th July, 1958. 3933

JOSEPH LUCAS
(ELECTRICAL) LIMITED

Great King Street, Birmingham, 19

ENGINEER

EXPANSION of development of ignition equipment for gas turbines and allied projects creates a vacancy for a practical engineer with experience of design for economic production of electrical apparatus. The work is of a high technical standard and applicants should preferably possess an honours degree.

The post is permanent and pensionable and offers considerable scope for advancement to a progressive engineer.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, 19, quoting reference PM/D/190.

128

W. T. GLOVER & CO. LTD.

Trafford Park, Manchester, 17

require an

ENGINEER FOR HIGH-VOLTAGE CABLE LABORATORY

Applicants must have had experience in the installation, maintenance and calibration of testing plant as this will be the primary responsibility.

The person appointed will also be expected to assist with development work on supertension cables and accessories, but experience in this field is not essential.

Applicants should be graduate members of I.E.E. and between the ages of 23 and 40 years.

This is a responsible and important position with prospects of advancement and carries a good salary commensurate with qualifications and experience.

Staff pension fund in operation.

Applications giving details of age, experience and qualifications should be addressed to the Secretary. 3949

SENIOR ELECTRICAL ENGINEER

INTERNATIONAL COMBUSTION Ltd., Derby, have a vacancy for a SENIOR ELECTRICAL ENGINEER to take charge of all projects involving electrical and control gear.

Further details on request. Highest salary paid to suitable candidate.

Reply giving full particulars to :—

Chief Engineer
INTERNATIONAL COMBUSTION LTD.
Derby

3928

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointments at Tilbury Generating Station, Tilbury, Essex :—

GENERAL ASSISTANT ENGINEERS.

Salary within the range of Class K, Grade 17, £590 × £15 to £635 p.a., and Grade 14, £740 × £15 to £785 p.a., inclusive of London weighting, plus 10% shift allowance.

Duties include periods of shift duty, involve assisting in the operation, testing, efficiency control and maintenance of electrical, boiler and turbine plant, and provide a suitable basis for promotion to higher technical grades.

Applications, quoting Reference No. 2/9360, stating age, qualifications, experience and present position should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts, to arrive not later than 5th July, 1958.

W. N. C. CLINCH,
Controller. 3954

JOSEPH LUCAS (ELECTRICAL) LIMITED

ASSISTANT ELECTRICAL DESIGN ENGINEER

required for the design of rotating electrical machines and electro-magnetic devices. Projects will include fundamental design investigations, and full scope will be given for initiative and imagination.

The post is permanent and pensionable.

Apply in writing stating age, qualifications and experience to the Personnel Manager, Joseph Lucas (Electrical) Limited, Great King Street, Birmingham, 19, quoting reference PM/D/221.

125

SWITCHGEAR DESIGN ENGINEERS

A LARGE American Corporation requires experienced Designers at their Engineering and Research Division located in California.

Candidates, preferably B.Sc.(Eng.) Degree or Corporate Member of the Institution of Electrical or Mechanical Engineers, must have experience in fundamental design of oil and/or air blast circuit breakers of extra high voltage and/or a specialised knowledge of one or more of the following :—

- High-voltage phenomena and insulation design.
- Power system control and relay application.
- Pneumatic or hydraulic circuits and components.
- Calculations, strength of materials, pressure vessels and dynamic analysis.

Candidates must have had a minimum of 5 years' experience with a manufacturer of high-voltage switchgear.

Passage will be provided. Contribution superannuation is available.

This is a splendid opportunity for enthusiastic engineers wishing to express talent and initiative. —Box 3946.

MINISTRY OF LABOUR AND NATIONAL SERVICE

ELECTRICAL INSPECTOR OF FACTORIES. Pensionable post in Glasgow for man or woman at least 35 on 1st July, 1958, who has achieved Corporate Membership of Institution of Electrical Engineers and has several years' professional experience. Responsible experience in electricity supply undertakings or manufacturing works an advantage.

Salary scale (men) £1,340 (lower if under 37) to £2,000. Promotion prospects.

Write Civil Service Commission, 30, Old Burlington Street, London, W.1, for application form, quoting S4854/58/7. Closing date 15th July, 1958. 3929

CENTRAL ELECTRICITY GENERATING BOARD

Assistant Engineer, Nuclear Plant Design Branch

ASSISTANT ENGINEER required in the Instrumentation and Control Section of Nuclear Plant Design Branch at Headquarters, London.

Candidates should have a Higher National Certificate or degree or have other suitable technical qualifications in Physics, Electronics or Light Electrical Engineering, with practical experience preferably in works or laboratory. Successful applicants will be given specialised training.

Salary within scales £870-£1,045 or £1,105-£1,315 p.a.

Application forms, obtainable from S. S. Scott, Chief Personnel Officer, 24-30, Holborn, London, should be completed and returned in envelopes marked "Confidential," ref. ER/172, by 18th July. 3955

COLVILLES LTD.

invite applications for the position of

SHIFT CHARGE ENGINEER

for the power station of their new Ravenscraig Works at Motherwell. The station has an initial capacity of 30 MW of electrical plant and 25,000 h.p. of other turbine plant.

The power station is also the control centre for all power services—electricity, gas, water and steam—within a large integrated iron and steel works, and this position offers a wide field of interest.

All applicants should have suitable qualifications and experience in boiler, turbine and switchgear operation.

Possession of a Higher National Certificate will be an advantage.

The position is superannuable.

Applications should be made to the Works Manager, Colvilles Limited, Ravenscraig Works, Motherwell. 3865

ELECTRICAL CONTRACTS ENGINEER, IRAQ

OLD-established electrical engineering contractors require qualified engineer (Graduate I.E.E. or H.N.C.) to control contract in Iraq. Practical experience in site supervision of all types of electrical installation work essential. Overseas experience an advantage. Excellent prospects of promotion to managerial position within the company.

Age 30/40, married or single. Two-year contract. Free air passage, furnished accommodation and medical attention. Separation allowance payable if wife in U.K.

Salary £1,600 to £1,800 per annum according to age, experience and qualifications.

Replies to—Box 3950.

MAINTENANCE ENGINEER

required for large engineering works in Manchester. Applicant, age about 45, should have a wide practical experience in mechanical and electrical engineering and have had some drawing office experience. Minimum qualification H.N.C., and preference will be given to candidates who have had experience in a similar post.

Duties will include the supervision of machine tool, millwright, electrical, pipefitting, power plant, building sections, etc., each under its own foreman. The Maintenance Engineer will be responsible to the Works Engineer.

Reply, stating salary required and giving full description of qualifications, to—Box 3947.

ELECTRICAL ENGINEER REQUIRED FOR GREECE

THE British-owned Athens Piræus Electricity Company requires a fully qualified British Electrical Engineer urgently. Short-term contract carries very substantial salary. Executive experience in similar company essential, preferably abroad. Age over 40. Responsibilities include labour utilisation within undertaking which employs 3,000 and also general administration work on engineering side.

Applications should be sent to the Secretary of the company's London Agents, Whitehall Securities Corporation Ltd., 47, Parliament St., London, S.W.1. 3972

BRITISH STANDARDS INSTITUTION

Technical Staff

THE B.S.I. invites applications from electrical engineers to joint the technical staff of the Institution. The technical staff are responsible for the work of the Institution in the preparation of British Standards in co-operation with the various sections of industry and are required to plan and progress the work.

Applicants should have a university degree or equivalent professional qualification in electrical engineering, and experience in telecommunications or illumination engineering would be an advantage.

There are three grades of appointment, with an overall salary range up to £2,000 ; applications are invited for the grade which has at present a maximum salary of £1,250, the starting figure being dependent on individual qualifications and experience. The posts are pensionable.

Apply to the Establishment Officer, B.S.I., 2, Park Street, London, W.1. 3916

CENTRAL ELECTRICITY GENERATING BOARD

General Assistant Engineer (Protection)

GENERAL ASSISTANT ENGINEER (Protection) required in Electronics and Instruments Section of the Research Laboratories, Leatherhead. Work covers a wide variety of problems arising from the use of protective systems, relays and similar devices. Development of new techniques and fault throwing tests on the system are also carried out. Candidates should have a degree, H.N.C. in Electrical Engineering or equivalent, and preferably some experience in this field. Salary £550 - £725 per annum.

Applications stating age, qualifications, experience, present position and salary should be forwarded to S. S. Scott, Chief Personnel Officer, 24/30, Holborn, London, E.C.1, by 14th July. Envelopes should be marked "Confidential." Ref. ER/170. 3956

ELECTRICAL ENGINEER

A VACANCY has arisen in the London West End head offices of a very large sub-contracting organisation for an

ELECTRICAL ENGINEER

with extensive experience of design, estimating and supervision of all types of contracts. This is a senior position and applications are only invited from engineers engaged on similar work with large sub-contractors. Outside staff will not be considered. The successful candidate will be required to be responsible for contracts from the initial enquiry stages through to completion.

Salary up to £1,500 p.a.

Please write giving full details of age and experience to—Box 3914.

ASSISTANT CHIEF ELECTRICAL DESIGNER

OPPORTUNITY in Glasgow for a young man with experience in A.C. motor design to assist Chief Electrical Engineer on development of A.C. rotating machinery and factory installation.

Applicants should state technical qualifications, age and previous experience. Canteen and sports facilities, good pension scheme coupled with free life assurance.

Box 3932

BIRMINGHAM REGIONAL HOSPITAL BOARD

SENIOR ASSISTANT ENGINEER (Electrical), £975 × £35 (1) × £30 (5) to £1,160. Applicants must be A.M.I.E.E. and have wide electrical utilisation and drawing office experience. Duties will be those of Group Leader to Assistants carrying out site surveys, preparation of estimates with quantities, plans and specifications for electrical services, and supervision of new works in hospital premises.

Apply, stating age, qualifications (with dates), experience, present post, and names of two referees, to Secretary, 10, Augustus Road, Birmingham, 15, by 7th July, 1958. Superannuable. 3940

Situations Vacant (continued)

ROBERT GORDON'S TECHNICAL COLLEGE, ABERDEEN

Department of Electrical Engineering

Head of Department :
Eric Wilkinson, B.Eng., Ph.D., M.I.E.E.

APPLICATIONS are invited for the post of LECTURER in Electrical Engineering. Applicants should be Honours Graduates and should have specialised in Electrical Power. Salary scale £785 to £1,350 per annum, with initial placing according to experience. The successful candidate will be expected to take up his duties on 1st September, 1958, or as soon thereafter as possible.

Further particulars and forms of application may be obtained from the undersigned, to whom completed applications should be returned on or before 5th July, 1958.

A. C. WEST,
Director. 3931

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

SHIFT CHARGE ENGINEER required at Castle Meads Power Station, Gloucester. Superannuation scheme. Salary N.J.B. Class E, Grade 7, £835 × £15 to £880 plus 10% shift allowance.

Applicants should have had considerable experience in modern power station operation.

Qualifications leading to graduate or corporate membership of a recognised engineering institution or equivalent desirable.

Closing date 7th July, 1958.

Applications on form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Rd., Bristol, 8, should be completed and returned by the date stated. 3970

AMBITIOUS YOUNG MEN

with commercial outlook and electrical engineering background are invited to join leading manufacturers of electric water heating equipment for interesting work in sales and design departments. Previous experience of electric water heating is not required, but applicants should have a sound technical education, together with an ability to correspond in good English.

The successful applicants will have excellent prospects of early promotion to executive posts in a live and expanding organisation. If you are ambitious and have the ability to succeed write now to Aidas Electric Limited, Sadia Works, Rowdell Road, Northolt, Middlesex. 3948

BALFOUR BEATTY & CO. LIMITED

have immediate vacancies for

CIVIL, ELECTRICAL AND MECHANICAL ENGINEERS

in their Design and Technical Offices in LONDON.

Applicants should have experience in engineering works, preferably connected with thermal or nuclear power stations. Good salaries and prospects are offered. Pension fund. Free luncheons. Five-day week.

Write details age, qualifications and experience (I.A.M./112), 66, Queen Street, London, E.C.4. 3971

SITE SUPERVISORS WANTED

SENIOR ENGINEERS (2) urgently required for site supervision of services to large and important building project in Central London.

MECHANICAL ENGINEER must have wide experience in heating and ventilating and air conditioning plant installation.

ELECTRICAL ENGINEER must have wide experience in modern lighting and power installation.

Salary commensurate with experience and qualifications. Replies in confidence.—Box 3883

CROMPTON PARKINSON (WORKS) PRIVATE LIMITED, BOMBAY

require qualified engineers with degrees in either Electrical or Mechanical Engineering, with at least three years' postgraduate or engineering experience, for the following positions :—

(a) TRANSFORMER AND SWITCHGEAR PLANNING ENGINEER.
(b) TECHNICAL ASSISTANT (Rotating Machines).
(c) WORKS STUDY ENGINEER.
(d) MAINTENANCE FOREMAN.
(e) GENERAL ENGINEERING ASSISTANT.

Applicants must be Indian Nationals and should write with full particulars to Ref. WDC, Crompton Parkinson Ltd., Crompton House, Aldwych, London, W.C.2. 3959

PATENT OFFICE

EXAMINERS (men and women) for scientific, technical and legal work on patent applications. Age between 21 and 35; extension for regular Forces service and Overseas Civil Service. Qualifications: normally first or second class honours degree in physics, chemistry, engineering, metallurgy or mathematics, or equivalent attainment, or professional qualification, e.g., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.R.I.C.

London salary (men) £635-£1,410; provision for starting pay above minimum. Good promotion prospects.

Apply Civil Service Commission, 30, Old Burlington Street, London, W.1, for application form, quoting S128/58 and stating date of birth. 3953

M.K. ELECTRIC LIMITED

require an

EXPERIENCED SALES REPRESENTATIVE

for

CLYDESIDE & SOUTH-WEST SCOTLAND

THE successful candidate will be required to live in Glasgow. If you have experience in dealing with architects, electrical wholesalers and contractors, are a car owner, and would like to join the sales team of a progressive company marketing products with a world-wide reputation, we would like to hear from you in confidence. Write in the fullest detail to :—

The Sales Manager, M.K. Electric Ltd.
Wakefield Street, London, N.18
3807

A SENIOR POWER ENGINEER

position is open in the Engineering Department of a major oil company based in London, necessitating occasional visits overseas.

Candidates for this post must be under forty years of age and have had several years of experience in the design of thermal power stations both from the steam and power generation sides, and be familiar with the design and layout of the distribution systems required to cover large installations.

A generous salary commensurate with qualifications and experience can be offered. Apply with fullest particulars, age, qualifications, experience, etc., to—Box 3858.

A YOUNG man with commercial outlook and sound electrical engineering background is required for interesting work in the sales and design department of an expanding organisation manufacturing selenium metal rectifiers, transformers, and equipment. Previous experience in this field is not essential. Applicants should possess a sound technical education, together with an ability to correspond in good English. Apply—Automat, 366, Moorside Rd., Swinton (Tel. SWInton 4242). 3776

CONTROL gear engineer required, age 23-35, for layout and circuiting of contactor equipment. Good salary. Permanent and progressive position. Canteen, pension scheme. Write stating age, experience and qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 273

EAST African installation contractors require supervising engineer, preferably experience abroad, age 28/35, for general work.—Box 3919.

DEPARTMENT OF HEALTH FOR SCOTLAND : X-ray engineer. Pensionable post for man at least 30 on 1.4.58. Qualifications: normally 5-year apprenticeship with H.N.C. in Electrical Engineering and at least 3 years' experience in engineering industry. Experience in design, manufacture and installation of X-ray and electro-medical equipment necessary. Salary scale £1,002 - £1,215. Write Establishment Officer, Department of Health for Scotland (Room 30), St. Andrew's House, Edinburgh, 1, for application form. Closing date 16th July, 1958. 3918

DRAUGHTSMAN required at consulting engineers' Glasgow office to assist on layout of 132-kV substations. Prospects of future promotion to engineer. Age 20-28 years. Training for H.N.C. essential. Holiday commitments honoured. Interviews Glasgow or London. Write to Kennedy & Donkin (D.S.H.), 4, Somerset Place, Glasgow, C.3. 3825

ELECTRICAL contract engineers. Opportunity for two young engineers to join staff of progressive company, one for electrical distribution and allied contracts and one for internal work. Write giving full details, experience and age.—Box 3905.

ELECTRICAL engineer primarily to lead the design of control systems for nuclear fuel handling and other interesting projects. Secondary function could include technical advice on production and sales. An opportunity for a young man with H.N.C. to increase his experience in a new field. Good salary and working conditions. Apply to the Personnel Manager, John Thompson Limited, Ref. "O," Wolverhampton. 3951

ELECTRICAL engineer required by old-established company. Preference will be given to those who have technical and commercial experience and have passed either the National or Higher National Certificate. The successful applicant will be required to sell a wide range of electrical equipment for heavy and light industry. There are excellent opportunities for advancement. Superannuation scheme. Write, giving details of age, experience and salary required to—Box 3934.

ELECTRICAL engineer required for preparation of schematic diagrams and associate detail engineering for automatic control equipment. Previous experience in this particular field of engineering essential. Good salary and prospects. Apply with full details to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 3920

ELECTRICAL engineer required for sales office, manufacturers West of London. Quotation and scheme preparation for automatic electrical equipment. Age 27-35. Salary £900 with prospects. Write in confidence—Box 3826.

ELECTRICAL firm with attractive retail showroom and small contracting business of good standing, requires capable electrician with high standards of service; able to drive. N.W. London. Good prospects for keen man prepared to train for responsible position. State age and full details of career.—Box 9399.

ENGINEER experienced all types overhead line work required for contracts in East Africa or Rhodesia. Write experience, giving age.—Box 3973.

FOSTER TRANSFORMERS Ltd., South Wimbledon, London, S.W.19, have a vacancy for a sales/contract engineer. Applicant should have had experience in a similar capacity. Apply with full particulars to the Personnel Officer. 3935

KEEN young draughtsman with machine shop training required for small production drawing office of company engaged in the manufacture of control gear equipment. Electromechanical experience desirable but not essential. Permanent and progressive position. 5-day week, pension scheme, canteen, etc. Apply giving full details of age and previous experience to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middx. 278

MANAGER for London office. A really live youngish man required for general office organisation, correspondence, tenders and despatches connected with the lighting fittings trade. Previous experience of this class of business, initiative and drive essential. Apply by letter only, giving full particulars, age, experience, commencing salary required, etc., to R. & A. G. Crossland Ltd., 55, Ebury Street, London, S.W.1. 3982

REPRESENTATIVE required by Northern manufacturers for London area. Good connection electrical domestic appliance trade. Salary, commission. Own car.—Box 3906.

MACHINE designer required by well-known firm for development post. Experience in design of motors essential, also alternators and D.C. an advantage. Interesting position offering good prospects at a salary commensurate with age, experience and qualifications.—Box 3847.

MANAGER required by electrical contractors in S.W. Devon coastal town, engaged on school, office, shop and industrial installations. Must have sound estimating, technical and administrative ability together with drive and pleasing personality. Applications in confidence with fullest details of experience, positions held and approximate salary required to—Box 3974.

REFRIGERATION sales and administrative engineer wanted for progressive company specialising in "service" for development in the London and Greater London area. Must be able to introduce new business. A genuine opportunity for a young enthusiast who is prepared to work for an executive position. Write in strict confidence to the Managing Director, Electrical Refrigeration & Radio Engineers (Epping) Ltd., 35, Little Russell Street, New Oxford Street, London, W.C.1. 3962

SENIOR design draughtsman required. Must be O.N.C. standard and preferably with previous experience in small electro-mechanisms. Salary will be at a high level but will depend on applicant's previous experience and suitability. The company is engaged in the manufacture of electro-mechanical devices including thermostats for room, water and domestic equipment. It is particularly in connection with this range of instruments the company wishes to expand. Situated in the Greater London area, consideration will be given to housing assistance. Our staff have been advised of this vacancy and all applications will be treated in the strictest confidence.—Box 3975.

SENIOR transformer draughtsman with experience of distribution transformers up to 1,000 kVA. Permanent and progressive position. London area.—Box 3763.

SIMPSON, BAKER & Company Limited require an experienced sales representative at their Exeter branch. One interested in training for management would be given preference. Remuneration by salary, commission. Expenses paid. Car provided. Superannuation scheme. Replies to be marked for the personal attention of B. M., 2/4, Smythen Street, Exeter. 3938

VACANCIES occur in a consulting engineers' office for junior and senior draughtsmen with experience in lighting and power installations in buildings. The posts offer opportunity for gaining experience in mechanical services also, and are progressive. Good drawing and printing essential. Five-day week, usual holidays. Apply to—C. MacKechnie, Jarvis and Partners, 34, in writing stating age, training and experience Victoria Street, London, S.W.1. 3976

YOUNG man age 24-27 to undertake period of commercial training in the London office of an old-established company manufacturing electrical switchgear, with a view to qualifying for an appointment as representative in Lancs/Yorks area. Some electrical knowledge and sales experience an advantage but not essential. A genuine interest in obtaining a progressive and long term career is more important.—Box 3977.

£1,000 a year plus bonus, pension scheme and excellent prospects of promotion offered to an electrical engineer who can develop sales of motors and generators up to 1,000 h.p. in London area. Apply giving age, education, training and experience to—Box 3843.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

B.Sc., A.M.I.E.E., 38, works engineering background, at present manager (commercial and technical) of overseas engineering company, invites proposals. Available interview U.K. now. Brief details please.—Box 9391.

ELECTRICAL supervisor (M.A.S.E.E.) requires situation with responsibility in the Tees-Tyne area. All offers seriously considered.—Box 9393.

ELEC. construction engineer seeks overseas contract. Extensive overseas history. Any field.—Box 9397.

ENGINEER (39), B.Sc., A.M.I.E.E., executive experience of development, project and sales of induction heating and control equipment, seeks progressive senior appointment.—Box 9398

SALES eng. requires position on North-East coast. Excellent connection with industry and shipbuilding in this area.—Box 9394.

SALES BY AUCTION

Twenty-ninth Sale **E. R.**

By Order of the Secretary of State for Air

R.A.F., STAFFORD
(on the main Sandon road, 2 miles from Stafford Town Centre)

SOUTH & STUBBS

are instructed to Sell by Auction on

WEDNESDAY, 9th JULY, 1958,
at 11 a.m.

at R.A.F., Stafford, C.D.O., N.A.A.F.I., H.Q. Site, a large quantity of

SURPLUS GOVERNMENT STORES

lying at R.A.F., Stafford, and R.A.F., Lichfield, including Aero and Radio Accessories, Engine and M.T. Spares, Caterpillar Chassis D.6, Plant Spares (Le Roi, Holman, Blaw Knox & Smith, Chaseside, Ransome & Rapier, Bamford, Smiths 5/20, Crossley, Wallace Stevens, Phœnix, etc.), Blaw Knox Blades, Plant Spares Track Links Type, Humber Engines, etc.

One view Monday and Tuesday, 7th and 8th July, 10 a.m. to 4 p.m., and morning of Sale.

Catalogues 1s. each (P.O. only) from the Auctioneers.

Auctioneers' Offices :
28, Eastgate Street, Stafford (Tel. 2331/2) 3925

ARTICLES FOR SALE

TURBO-ALTERNATOR SETS
500 volts, 3-phase, 50 cycles
for disposal in London area

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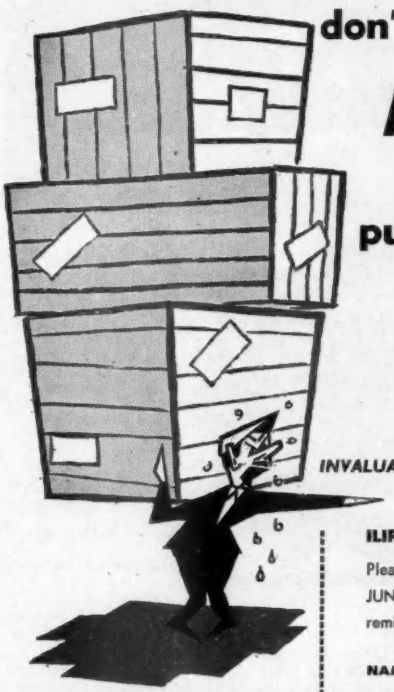

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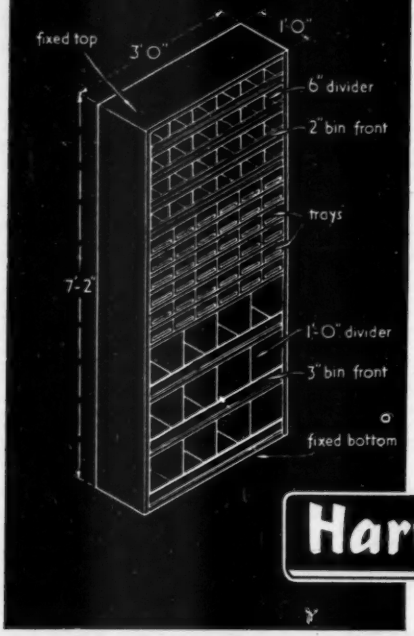

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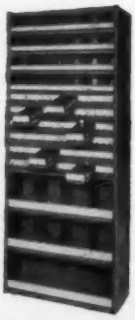

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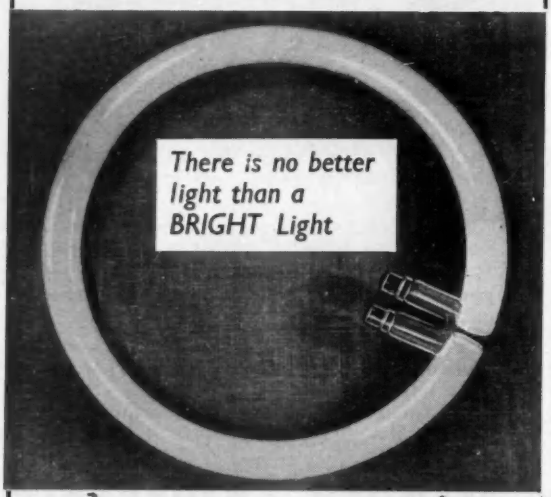

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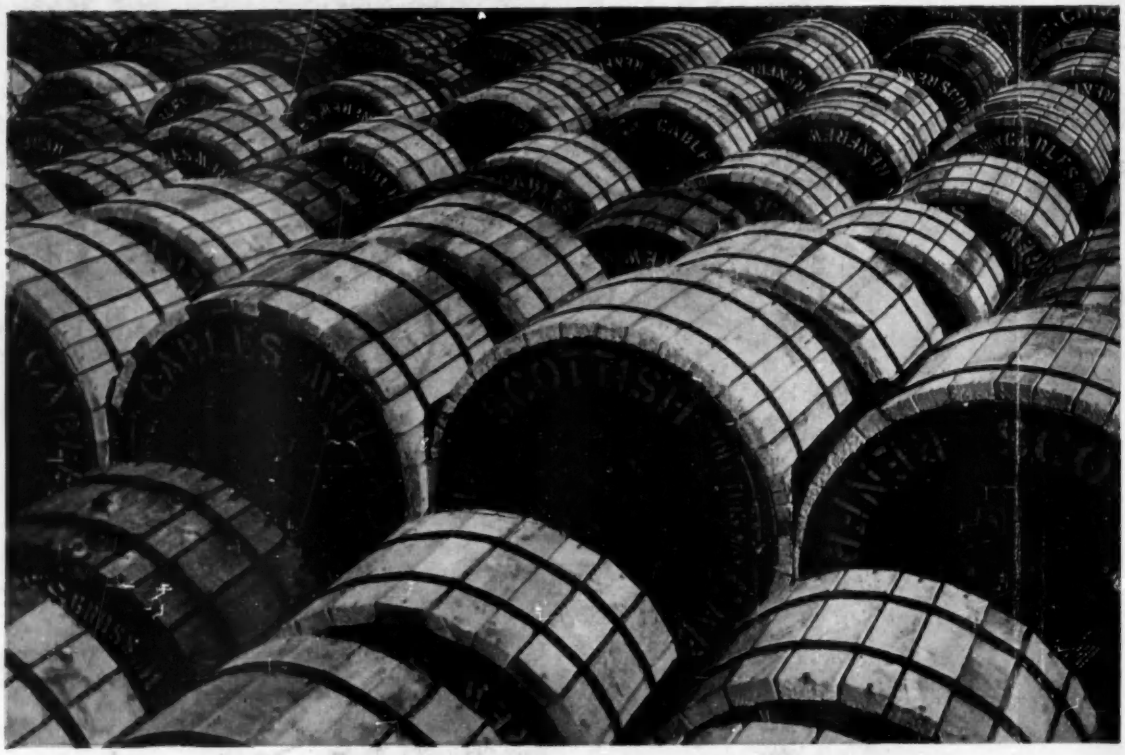

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